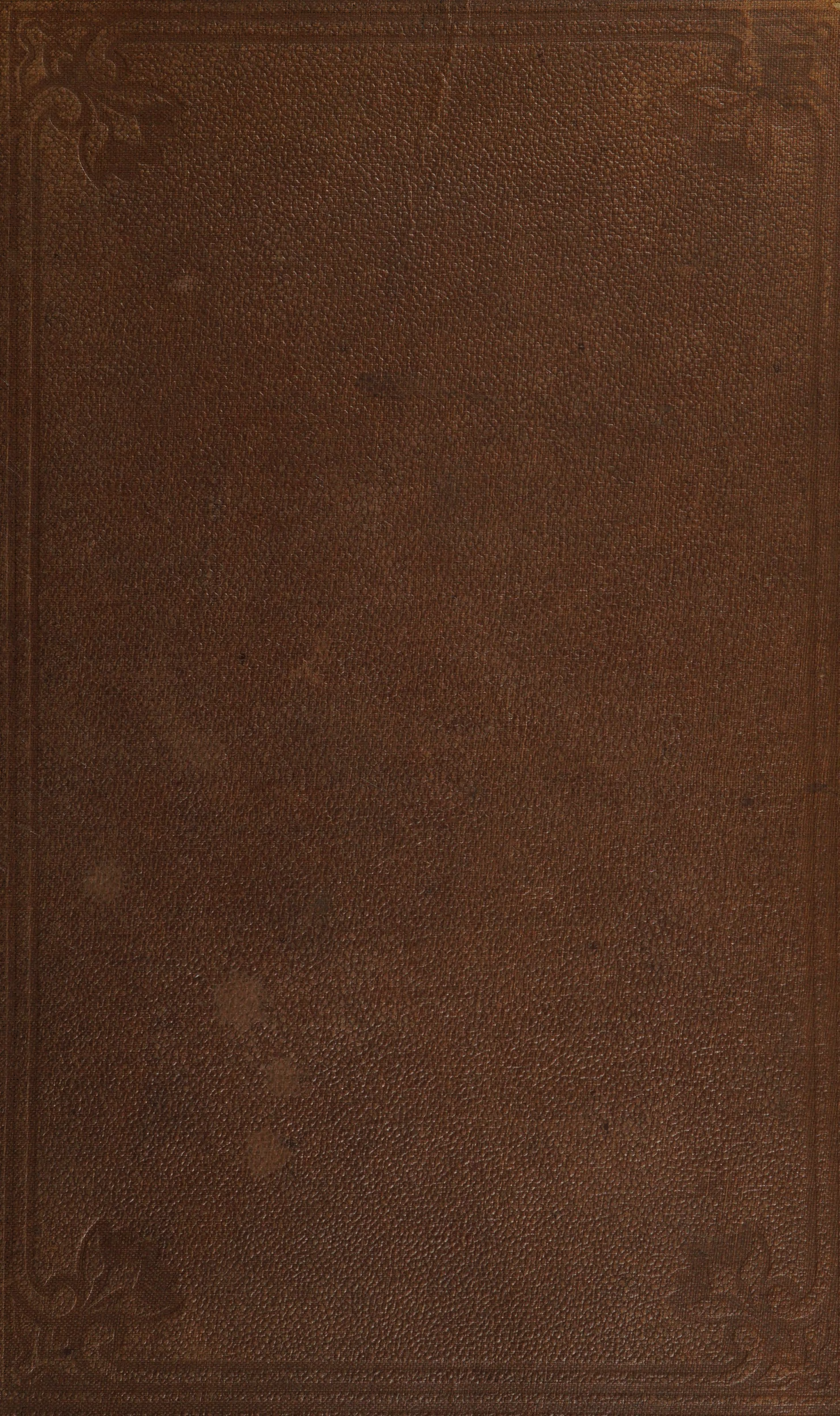

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A DESCRIPTION OF THE DISEASED CONDITIONS

OF

THE KNEE-JOINT.

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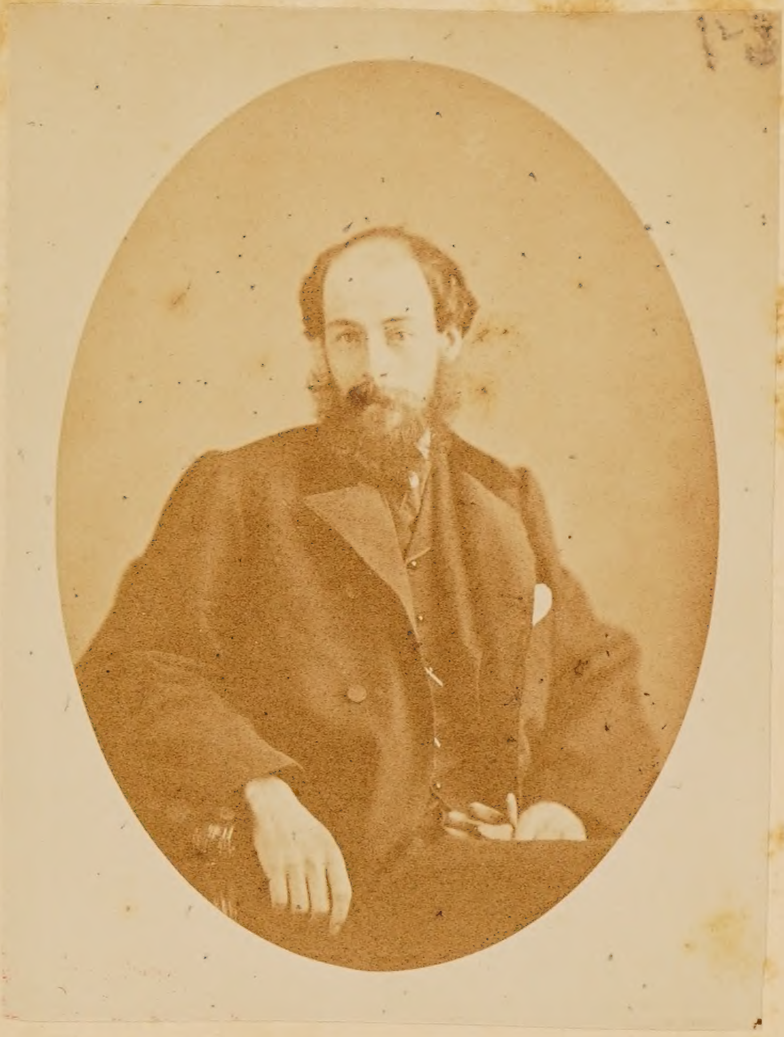

Joseph Thompson, Jnr

A DESCRIPTION OF THE DISEASED CONDITIONS
OF
THE KNEE-JOINT
WHICH REQUIRE AMPUTATION OF THE LIMB,
AND THOSE CONDITIONS WHICH ARE FAVOURABLE TO
EXCISION OF THE JOINT:

WITH AN EXPLANATION OF THE RELATIVE ADVANTAGES OF BOTH OPERATIONS AS FAR AS CAN BE ASCERTAINED BY CASES PROPERLY AUTHENTICATED.

BY
PETER CHARLES PRICE,
LATE SURGEON TO THE GREAT NORTHERN HOSPITAL.

EDITED, WITH A PREFACE AND MEMOIR OF THE AUTHOR, BY
HENRY SMITH, F.R.C.S.,
ASSISTANT SURGEON TO KING'S COLLEGE HOSPITAL.

MR J. W. SLACK
The Terrace,
69 SALTE[illegible]
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TO

WILLIAM FERGUSSON, ESQ., F.R.S.,

PROFESSOR OF SURGERY IN KING'S COLLEGE, LONDON;
SURGEON EXTRAORDINARY TO THE QUEEN.

MY DEAR SIR,—

It was under your kind auspices and tuition that the author of the following pages first became imbued with that ardent love for his profession which so eminently characterised him. Stimulated also by your example, he devoted himself to that particular branch of Surgery with which your name is so honourably connected, and the progress of which, indeed, forms the main feature in the history of our Art during the last thirty years.

He was one of those who, at a very early period of his career, fully appreciated the boon which you conferred upon Surgery when you revived the operation of excision of the knee-joint; and the following pages will testify that he has done more than anyone else towards establishing it as one of the most legitimate and useful proceedings which can be undertaken for the removal of disease.

I feel strongly convinced that, had our lamented friend been permitted to perform the task which I now execute for him, he would have seized the opportunity to show his gratitude to you, and his deep admiration of those eminent qualities which have raised you to the foremost place in Surgery in Great Britain. Impressed with this conviction, therefore, I take the liberty of dedicating this work to you, and of associating your name with one whose talents and virtues you so much admired, and whose memory you so deeply reverence.

I remain, my dear Sir,
Your attached and faithful Friend,
HENRY SMITH.

PREFACE.

I SHALL fully allude, in the Memoir of the author, to the circumstances under which the following Essay was composed, and the history of its rejection by the three members of the Council of the College of Surgeons who formed the Jacksonian Prize Committee. There has been no report made public as to the reasons which induced these gentlemen to take this step, and completely ignore the valuable mass of information which Mr. Price had collected on a subject which had, as yet, not taken its place in surgical literature. I have however heard, through sources which can be relied upon, that the Committee—one of whom only, be it remembered, had ever performed the operation of excision of the knee-joint, as far as is known at least—rejected the Essay on the grounds that all the conditions for the acquisition of the Prize were not fulfilled, and that Mr. Price had written rather an essay upon excision of the knee-joint than answered the questions proposed. I will grant that the author, in his zeal for the success of this lately revived mode of treatment, did devote the greater portion of the work to the consideration of excision of the knee-joint, and did not pay so much attention, as he might have done, to the comparison between this operation and amputation; but I doubt not that Mr. Price felt, as all others must feel, that it was not amputation of the thigh about which the Council of the College of Surgeons required information, but that the mode of treating disease of the knee, by excision of that joint, was the real question at issue: hence he in a measure, but in a measure only, ignored the subject of amputation—although I maintain that all who read this Essay carefully, will see that the author has clearly and sufficiently drawn the distinction between those cases which require amputation, and those to which the operation of excision is applicable. However, the Essay is now placed before a much higher tribunal than that constituted by the three members of the Council of the College of Surgeons, and the great body of British Surgeons will be able to arbitrate upon the matter; and with their verdict, I, who have undertaken to vindicate the claims of my lamented friend and colleague, will rest satisfied.

The question may be asked, why was not the Essay brought before the professional public long ere this, if, as had been assumed, any injustice had been done by the refusal of the Prize to the author? This question I can satisfactorily answer. Very soon after the Essay was returned to the author, I, in company with other friends, urged Mr. Price to publish the work, and he was considering the best means of effecting this object, one necessarily attended by great expense and trouble, when his health, already sorely tried by the daily and nightly labour bestowed upon the preparation of the Essay, and grievously depressed by the disappointment at its rejection by the College, completely gave way, and the matter was of necessity delayed.

Soon after his death, his family and friends, feeling keenly that in justice to the memory of the author the Essay should be made public, requested me to undertake the task. To this request I cheerfully assented, especially as I had the best reasons for knowing that Mr. Price had expressed a wish that I should superintend its publication; and I only regret that so long a time has elapsed before the work was completed, but such an undertaking as editing a posthumous work is surrounded with many difficulties. I may state that, in accordance with the wishes of his family and in consonance with my own feelings, I have not altered a word of the text as penned by the author. I have made some additions in the form of notes, and I have given the further experience of some of those surgeons who are mentioned as having performed the operation of excision of the knee; and by this means I trust that the work will be rendered more serviceable to my professional brethren.

It will be seen that only a part of the many valuable illustrations forwarded with the Essay are introduced. I regret that the whole of them could not be inserted; but this could not have been effected without incurring a large additional expense. I have therefore, selected those drawings which I thought would best illustrate the several points desired by the writer, and I have referred by a note to those drawings which are mentioned in the text, and have not been inserted. I must not, in connection with this subject, omit to pay a tribute of praise to Dr. Westmacott, who made many of the original drawings. My thanks also are due to Messrs. West and Hart for the admirable manner in which they have done their work.

It is impossible I think to refer to the contents of this Essay without reflecting upon the vicissitudes which excision of the knee-joint has gone through, from the period the operation was repeated some thirty years since by some of the leading surgeons of the present century, and condemned as useless, as well as from the time when it was revived by Mr. Fergusson in 1850, up to the period of the author's Essay. It is hardly conceivable that within the short space of ten years nearly three hundred cases of this operation should have been collected together, considering the very strong opposition which had been excited against the method by those who had tried it insufficiently, or who had not adopted it at all. It certainly appeared at one time as though the hostility directed against it as a surgical measure would prevail, and the mortality attending the earlier operations by Mr. Fergusson induced many, even amongst his own pupils, to look upon excision of the knee-joint with suspicion; but as the operations became multiplied, and surgeons became more familiar with the means of making them more simple, and improving the treatment after operation, it became very evident that the fatality would not be far different from that attending amputation through the thigh, and that the patient would, in addition, possess the inestimable advantage of a good and useful limb. Of this latter fact there was considerable doubt expressed at one time, but it is clearly shown in this Essay that the most serviceable limb may be preserved to the patient after the knee-joint has been removed, and ample evidence of the same kind has been obtained since this work was written; so that no one who has taken the trouble to investigate the subject can have the least doubt on this all-important point.

An inspection of the contents of this Essay will show what a large amount of labour the author bestowed upon it, and what valuable information he has brought together in connection with the subject. The work, whatever may be its shortcomings, will ever remain a monument of the author's industry.

In the first part the anatomy of the knee-joint is described; then is given at length a sketch of the various diseased conditions which demand the operation of amputation or excision. The history of the latter proceeding, both in this country and abroad, is next furnished. Then is given the analysis, with details of all the cases which have been performed in England, as well as of those which were operated upon in Germany, France, and America. Next follows a record of the cases which have occurred in Military Surgery. We are also furnished with an analysis of the fatal cases occurring after this operation. He makes an elaborate inquiry as to the cases to which the operation is applicable, and the circumstances under which it should be performed, and enters minutely into the objections advanced against the proceeding. In the latter part of the work will be found a consideration of these cases of disease of the knee-joint, which are to be treated by amputation, with the respective mortality after each operation; and lastly, the author sums up his own deductions, and gives us the result of his own experience in detail.

In conclusion I must beg to state that, although I have performed my task to the best of my ability, I fear many imperfections will be found in connection with it. During the whole of this summer my leisure moments have been devoted to the publication of this Essay; but the interruptions have been many and unavoidable: hence I must claim the indulgence of my readers, some of whom are well acquainted with the difficulties of editing a posthumous work like this.

I think it right to mention, in justice to the memory of the author, that I did not overlook the existence of a note which I found appended to this Essay by Mr. Quain, one of the Council of the College of Surgeons, calling in question the accuracy of the facts stated in reference to Mr. Quain's cases of excision of the knee. Seeing this note I thought it due both to the late Mr. Price and to Mr. Quain that this gentleman should have the opportunity of correcting any error which the author had fallen into in reference to the cases in question, and accordingly I wrote to Mr. Quain asking for a correction of this assumed error. I received a very courteous reply from that gentleman, but I could gain no information regarding the cases in question; hence I have thought it due to both, that the cases should stand as related in the text, and the note of Mr. Quain should be inserted as it was found. Mr. Quain wished that all reference to him and his cases should be omitted, but he will see at once that having undertaken such a duty as I have done, I could not possibly accede to his request, and as a non-compliance with his wish might appear to be an act of discourtesy on my part, I beg to furnish this explanation.

It might appear to some that it would have been in better taste had I omitted the very severe remarks which the author has thought fit to make in reference to the treatment pursued by some of the operators in the cases detailed; but I was requested to publish the Essay as it was written, and have therefore made no alteration of the text. It must be borne in mind by those gentlemen, who may feel somewhat severely handled, that the author was writing under an assumed name, and that at the time he wrote there was a great deal of excitement regarding the question of excision of the knee; Mr. Price felt warmly on the subject, and it was his wont to express himself as warmly. Had he lived to perform the task allotted to me, I doubt not he would have modified his expressions, but I do not feel permitted to make any alteration in the Essay whatever, so far as regards curtailing the text.

It will be seen that I have collected together a considerable number of cases of excision of the knee, which have been operated upon by surgeons whose names were mentioned in the author's list, since the year 1860. It has not been my purpose to mention all the cases which have occurred in Britain since this period, but I take this opportunity of stating that Mr. Bellamy, the surgical registrar of King's College Hospital, writes to me from the Devon County Hospital at Exeter, and informs me that there have been as many as eighteen cases of excision of the knee-joint in that Institution, and of these sixteen were successful; one patient died from the operation, and another was submitted to amputation.

Caroline Street, Bedford Square,
15*th August*, 1865.

MEMOIR OF THE AUTHOR.

It would not, I think, be right, in sending forth this posthumous work to the profession, of which when living the author was so distinguished an ornament, to omit some particulars of his career, from the period he commenced his medical studies until the day that he lay down to his rest calmly, peacefully, and in charity with all men; and I enter upon this part of my melancholy but pleasing task with the more facility, as from the time that he entered at King's College I was united with him closely in the bonds of friendship, and thus had the best opportunities of judging correctly of his social and professional character, and of ascertaining the means by which my friend contrived in a very few years to make himself so well and favourably known amongst the present generation of British surgeons.

The father of Peter Charles Price, who is happily still active in his professional duties in a green old age, was a favourite pupil of the late Sir Astley Cooper, and practised for some time in London, where his health gave way, and from whence he was compelled to withdraw to a more suitable locality. He settled at Margate, and there soon acquired a considerable practice, at the same time losing all traces of the illness under which he suffered whilst in London. Here was born the subject of this memoir in 1832, and, like many children possessed of a delicate frame, as he grew up he evinced a considerable acuteness of intellect and facilities for acquiring knowledge. At a very early period he showed a great fondness for and became very apt in the use of mechanical tools, an acquisition which was of great service to him in his career as a surgeon. On the completion of his school studies he determined to follow his father's calling; and having previously for a year devoted himself to the study of Practical Chemistry, under the superintendence of his brother, Dr. David Price, he entered upon his medical studies at King's College in 1850, and there at once began to display that energy and aptitude for learning which were subsequently such marked features in his character. He was one of those who feel the great importance of seeing as much of disease as possible, and who do not delay their attendance at the hospital until the commencement of their second session. Price knew the value of early impressions, and felt that facts connected with the study of disease, observed at an early age, remain longer and more firmly engraved upon the memory than if they are received at a later period: accordingly he was from the first an attentive visitor in the wards of the hospital, and a careful student in the Post-mortem Theatre. To show the practical turn of his mind, it may be mentioned that he soon competed for and won the prize for Clinical Surgery; and this circumstance, together with his diligence at the bedside in the surgical wards, soon attracted the attention of his teacher, Mr. Fergusson, to whom he in return became deeply attached, and thus that friendship was formed which, in the main, influenced his subsequent career throughout his life.

In 1854 Price obtained his diploma from the College of Surgeons, and it had been his original intention to join his father at Margate; but at this period Mr. Fergusson had attained that lead in Surgery which he now so deservedly maintains, and of necessity he required a staff of experienced and active assistants. Price had already acquired his confidence, and accordingly determined to take his chance, and fly at "high game," as the phrase goes, in the great metropolis. He was the more induced to take this step, as a younger brother, the present Dr. William Price, of Margate, was being educated also at King's College, and would soon be in a position to relieve his father from some of the anxieties and responsibilities of his large practice. He was continually engaged with his chief in the numerous operations which this surgeon undertook, and he made excellent use of the opportunities thus afforded him of forming his character as a practitioner. He read hard, worked well, and soon evinced a very lively interest in all that pertained to operative Surgery in particular. He soon became attached to the Blenheim Dispensary, and acted as surgeon to the Infirmary for Sick Children at Margate, where a large number of the unhealthy offspring of the poor of London were transmitted for medical and surgical treatment. Here Price had considerable opportunities of seeing cases of diseased joints, in which he began to take so much interest, and here also he had an ample field for observing the various forms of scrofulous disease; and that he made excellent use of these opportunities is evident from the able and practical work on Scrofula which he published just prior to the commencement of his long illness. It was here also that he first had the opportunity of performing the operation of excision of the knee-joint. Like many other of his fellow-pupils, he had become much interested in this mode of treating incurable disease of the knee-joint, which had been revived at King's College Hospital whilst he was going through his studies there; he watched all the cases with extreme care, and he became convinced, notwithstanding the occurrence of much fatality in Mr. Fergusson's earlier cases, that the operation should be substituted for amputation in most instances of disease requiring the supreme treatment. He investigated this subject with the utmost anxiety, devoted much attention to perfecting the after treatment—a matter of such great moment in reference to excision of the knee-joint in particular—and published some admirable papers in connection with this highly conservative proceeding. I think I may fairly state that next to Mr. Fergusson, Mr. Jones, of Jersey, and Dr. Butcher, of Dublin, the subject of this memoir has contributed most towards the establishment of excision of the knee-joint as a legitimate proceeding in Surgery. He knew what difficulties those surgeons had to contend against who were labouring both by practice and precept to dispel the prejudices manifested against the re-introduction of this operation; and feeling convinced of the ultimate issue, he fought valiantly in the ranks of conservative Surgery, and fortunately lived long enough to find excision of the knee-joint regarded as one of the most brilliant achievements of modern Surgery. It will be seen by referring to the text that, during the brief period he was permitted to practise his profession, he performed the operation no less than seven times, with a very encouraging success. He was the first surgeon in England to adopt it for remedying the deformity produced by an awkward anchylosis of the joint, rendering the limb useless; and since this operation was performed, several instances of the same kind have occurred in the hands of Mr. Fergusson, and two by myself, and most useful and serviceable limbs have been preserved, in instances where a few years since amputation would have been the only resort.

When the Great Northern Hospital was fairly instituted, a staff of medical and surgical officers was required, and Price was chosen as one of the assistant-surgeons, and here he had opportunities of displaying his operative dexterity on a larger scale, and before audiences which were severely critical upon the young surgeon; but it was soon apparent that he was equal to any emergency which might arise in connection with operative Surgery. A great admirer of his old teacher, he closely imitated him, and displayed much of that dexterity, calmness of demeanour, neatness, and attention to detail, which, when combined with a knowledge of diseased and healthy tissues, are qualities essential to form a first-class surgeon. He was fortunate in getting several operations for stone in the bladder, both in private practice and at the hospital. I witnessed or assisted at most of these cases, and I must confess I was perfectly astonished at his dexterity on these occasions. I feel sure that, had he lived, he would have equalled his old master in the wonderful skill he displays in the operation of lithotomy. It has happened to me to see this operation performed a great many times, and by many surgeons; but, with the exception of Mr. Fergusson, I have not seen anyone complete the entire business with such credit as Price.

Price was at this time working very hard, not allowing a single opportunity to be missed, by which he could hope to make himself a good surgeon. He was at this time in constant intercourse with Mr. Fergusson, attending with him in all his operations, and assisting him in various ways; and the immense value to him of this intimate association was deeply appreciated. The constant fatigue he was exposed to, combined with hard study,—I fear long after the hour he ought to have sought his night's repose,—began to tell upon his naturally delicate frame, and in the year 1858 his friends became alarmed at his altered appearance. He, however, took warning, and gave himself a holiday for a month, visiting Paris, Rome, and Naples, and returned to his work in his accustomed health. Private practice began to increase : he took a house in Green Street, Grosvenor Square, and married a lady in all respects worthy of him; and about this period occurred that event which produced a profound impression upon him, and excited him to the utmost. The Royal College of Surgeons had announced for 1860-61, the following title as the subject for the Jacksonian Prize Essay :—"A description of the diseased conditions of the Knee which require amputation of the limb, and those conditions which are favourable to excision of the joint; with an explanation of the relative advantages of both operations, as far as can be ascertained by cases properly authenticated." And to use the eloquent words of his friend and biographer, Dr. Webb, "With his wonted energy Price threw himself into the work. He sacrificed his leisure, and even his rest, to it; and he produced an essay on excision of the knee-joint, which for the fulness with which the subject is treated, the vast number of facts brought together, the beautiful preparations, drawings, and photographs which accompanied it, is unequalled in the records of conservative Surgery."

An immense amount of labour was bestowed upon the compilation of this Essay; it entailed not only a large extent of personal research and observation, but a large correspondence was necessary in collecting data connected with the operation, from all parts of the United Kingdom, from the Continent, and from America. Knowing, as he did, that few besides himself could have had the same opportunities of observing facts in reference to this proceeding, he looked forward with the utmost confidence to the result of the award. Those few of his friends who knew what he was about, were equally sanguine with himself. And I can truly state that it was from the knowledge that Price was writing for the prize, that there was no other competitor for the same. A very distinguished and well-known fellow pupil had already collected material for the Essay; but on its being represented to him that such a formidable adversary as Price was working for the prize, he gave up the task.

After months of labour, both night and day, the Essay was completed, and sent into the College, accompanied by numerous illustrations and preparations. At this period, viz. 1860, the time-honoured custom of re-election to the Council—the "*imperium in imperio*"—had not been broken through, and there were but few members of this august body who practically knew much about conservative Surgery. Such men as James Paget, Henry Hancock, and William Fergusson, had not a seat there then, unfortunately for poor Price. Will it be believed that, of the three gentlemen who were appointed to adjudicate for the Prize, only one of them had ever performed the operation of excision of the knee-joint! Most of my readers will agree with me, I think, in stating that the Council of the College of Surgeons had no right to propose such a subject for the Jacksonian Essay, if they could not find amongst their body three surgeons who were capable, from practical experience, of adjudicating upon such a much-vexed question as the relative merits of curing disease of the knee-joint by amputation or excision.

The result of the deliberation of the three gentlemen appointed by the Council was, as might be pretty well anticipated under such peculiar circumstances, that the Essay was returned to its author as not worthy of their acceptance; and this, *notwithstanding that no other essay was sent in.*

I need not say that this blow fell upon poor Price with stupendous weight. He spoke little of the disappointment, except to a few of those nearest and dearest to him; but his ardent, sensitive spirit was deeply wounded, and it was not long before his weakly frame again began to show signs of impaired energy. Nevertheless, on its being announced that there were vacancies for two assistant surgeons at King's College Hospital, he put in his well-earned claims; and, in conjunction with myself, was elected to the office. This event was a balm to his spirit, for he always looked forward to the possibility of being connected with his old hospital, and to be associated officially with his old teacher; but the bow had been already bent to its utmost. Hardly a month had elapsed from the commencement of his new duties, before phthisical symptoms suddenly set in, and an alarming hæmorrhage nearly destroyed him. He, however, rallied under the judicious care of his friend and colleague, Dr. Webb. It was found that a more genial clime must be sought, and therefore he determined to winter in Mentone. Here he recovered strength so rapidly that he was enabled to enter upon private practice, and getting better he returned to England in the spring of 1862, but the climate did not suit him, and he was compelled to return again to Mentone, with which place he was enraptured; but his disease did not appear to get any check from this second visit, and the summer of 1863 he spent at Bellagio, on the Lake of Como, and thence returned to Mentone in the latter part of the autumn. In his first and second visits to this place his letters indicated an unsubdued exuberance of spirits and interest in everything that was going on in connection with his professional friends in England; but about the latter period of this third visit, it was evident that he had begun to feel the effect of his exhausting disease, and that his spirits had become subdued; there were, however, calmness, cheerfulness, and resignation evinced, very pleasing to contemplate—a careful and thoughtful consideration, too, of the misfortunes and sufferings of others.

About this period he wrote a long and interesting letter to me, in which these points were especially illustrated. He referred to his life at Bellagio, and described the pleasure it gave him to see some well-known professional faces there. "One very happy evening," he says, "was spent at Bellagio with Mr. Paget, who came there bounding with good spirits, and the lines of care well filled in. He is an excellent man, and doubly great, because I am sure he is a good man." I know Mr. Paget will excuse this reference to him from one who thoroughly appreciated the qualities of head and heart for which he is so deservedly esteemed.

In this same letter Price spoke of the happiness he had experienced during his stay at Bellagio. He says, "We have had really a pleasant summer, and experienced many of those happy realizations of which poets sing, and which elevate the young mind with hopes and joys ere the great big beast of care and sorrow tramples them under foot." Again he says, "In health I am more than tolerable, but the molehill is the mountain, and physical prowess fails to answer always to the goad of good spirits and a happy mind. My wife and child are in the firm grasp of health, and so I have everything to thank God, and to rest and be thankful." Then, again, referring to the recent deaths of friends in England, he says: "But while I am so happy and comparatively well, death has been busy amongst those who had fairer hopes of life." It was thus this bright and genial spirit, in the midst of his own infirmities and disappointments, showed his submission to the dispensations of Providence, and his sympathy for the trials of others.

He passed this winter at Mentone, and subsequently moved to Fontainbleau and Compiegne; then, evidently feeling his end approaching, he made an effort to return to his native land, which he reached in the summer of 1864. Some time was spent at Hastings, thence he was carried to Ventnor, where, on the 13th of November, he peacefully yielded up his spirit. He was buried in Margate, and, with others of his attached friends, I had the melancholy pleasure of paying the last tribute of respect to my lamented colleague.

Thus died, at the age of thirty-two, one who, in a few short years, had contrived to make a name which will always be remembered most worthily in connection with that department of Surgery to which he devoted himself so ardently. Had his life been spared, I think there can be no doubt that Price would have outstripped, in reputation and in practice, many of his surgical compeers, for there were in his character all the elements of success. I have already alluded to the extraordinary mechanical skill which he possessed, and which even his most bitter enemy—if there was such a being—could not deny to him; but, in addition to this, he was endowed with a large share of sagacity and acuteness of perception, which is so valuable to a surgeon. He had a tenacious memory, yet he did not trust to it. He was accustomed to note everything down in writing; and, as an instance, I may mention that

I have heard him say he had in his note-books particulars of every important operation which he had attended in Mr. Fergusson's practice.

To these excellent qualities were added a personal appearance and manner remarkably attractive, and which inspired his patients, both in private and in public, with a large amount of confidence. He was an uncommonly sensitive man; but in all my intercourse with him I may truly say I never once saw him lose his temper. And during his long illness he showed neither impatience nor fretfulness in conversation or in his letters; on the contrary, as I have before observed, there were evinced in him a manly yet proper resignation, and a careful consideration for the trials of others; and, therefore, it is not a matter of wonder that so much real sorrow should have been expressed for his premature removal from this earthly scene, and that such handsome tributes should have been paid, by the organs of the medical press, to the memory of one who died so young, but yet lived long enough to leave a permanent name amongst the benefactors and ornaments of Surgery.

H. S.

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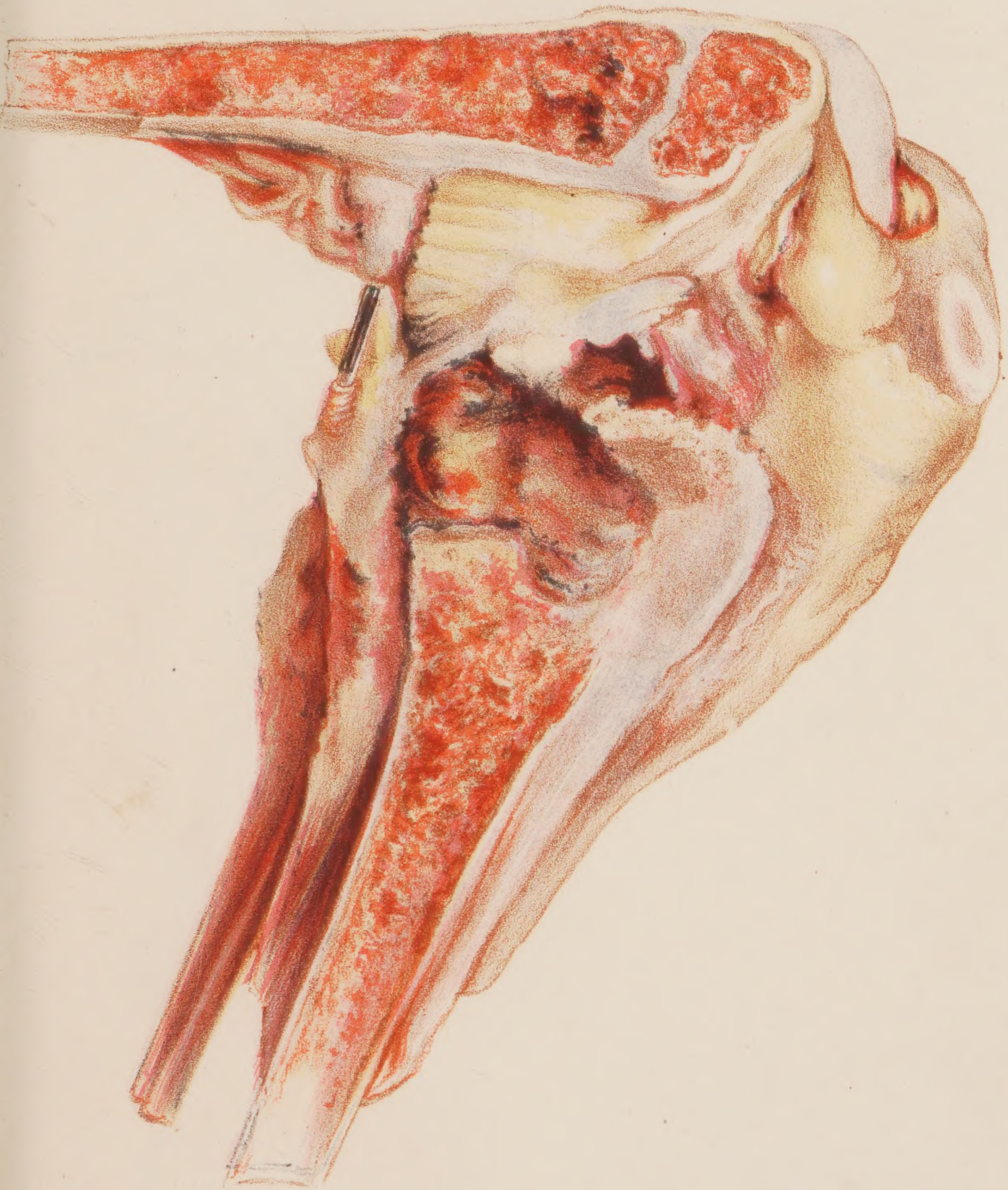

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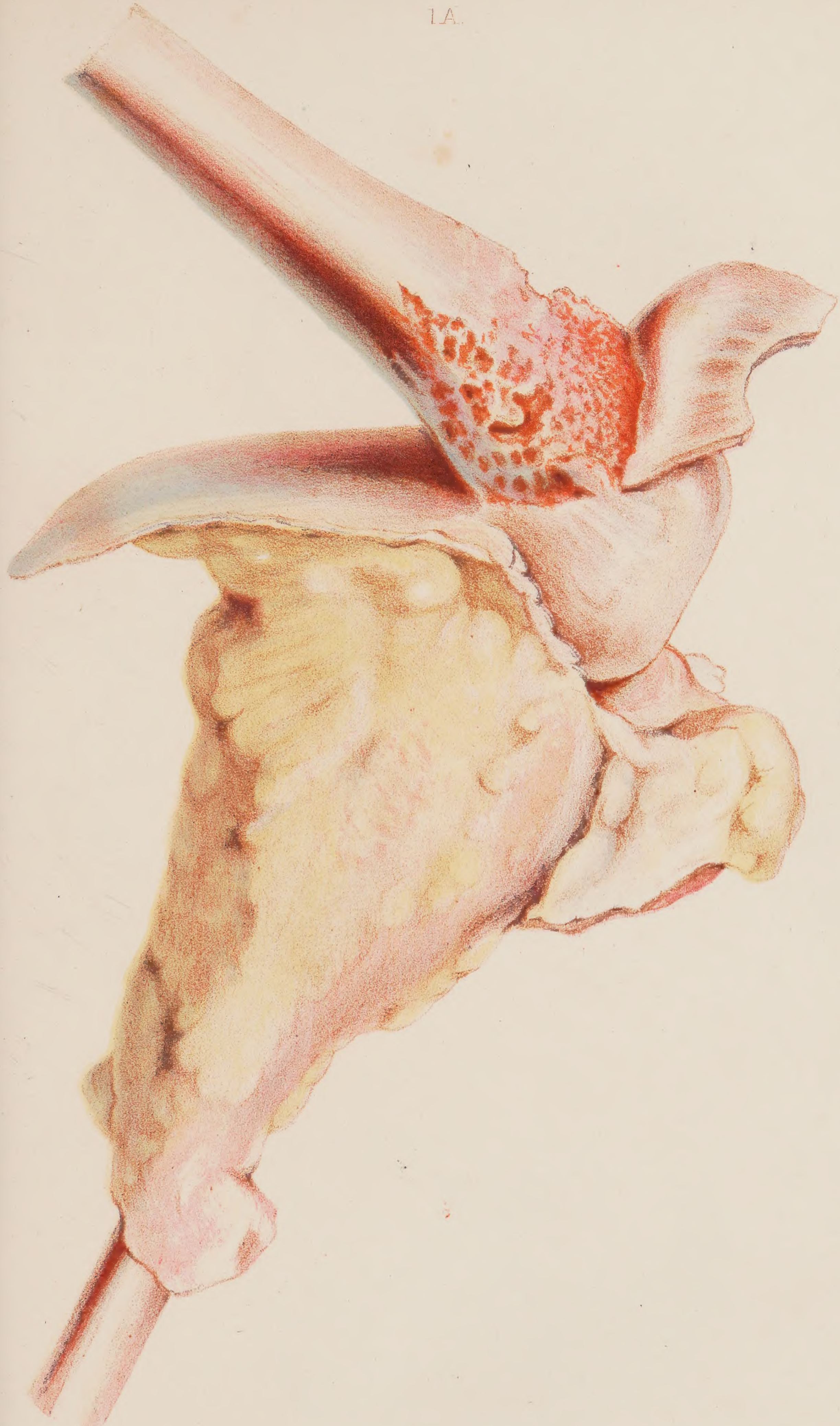

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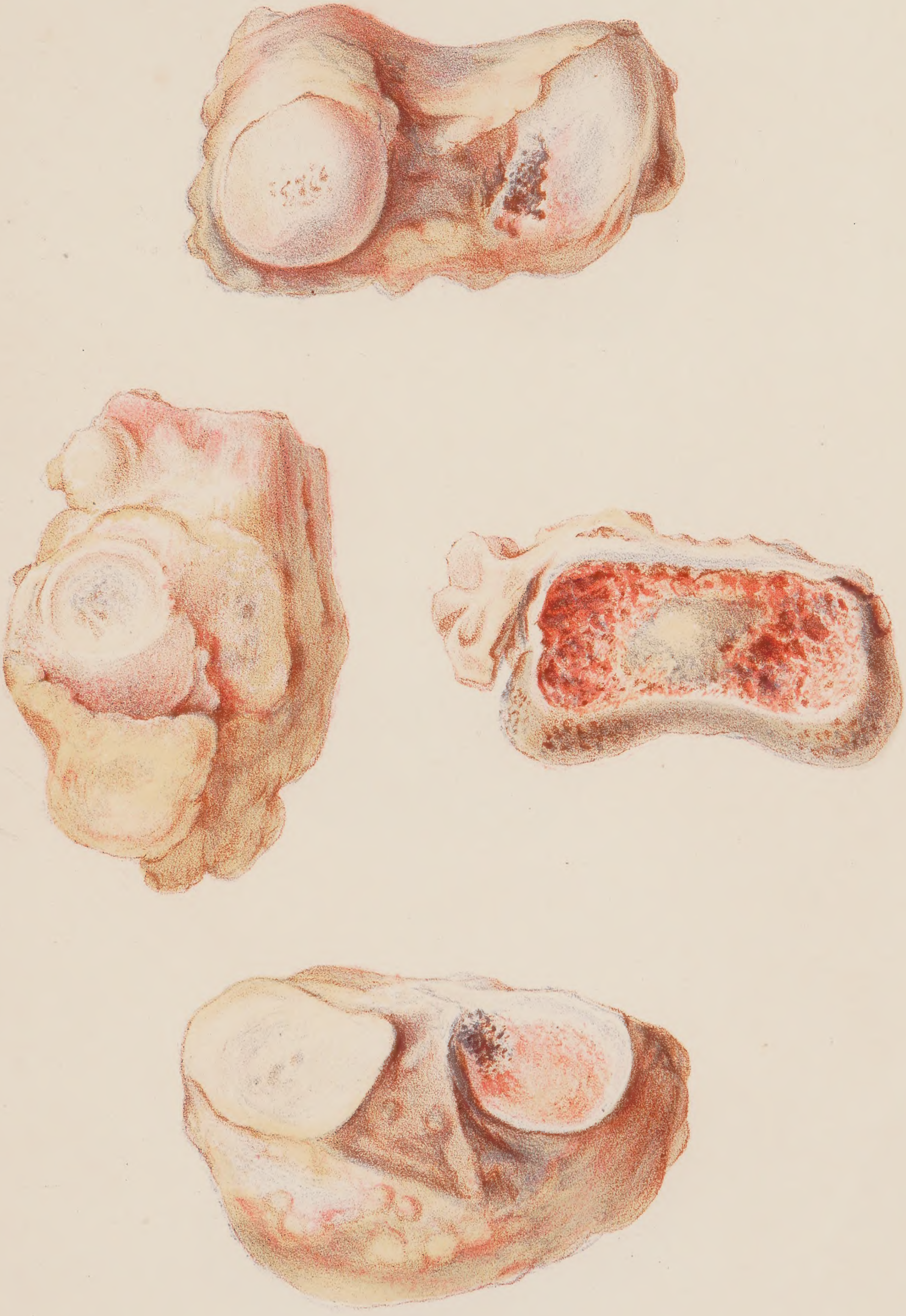

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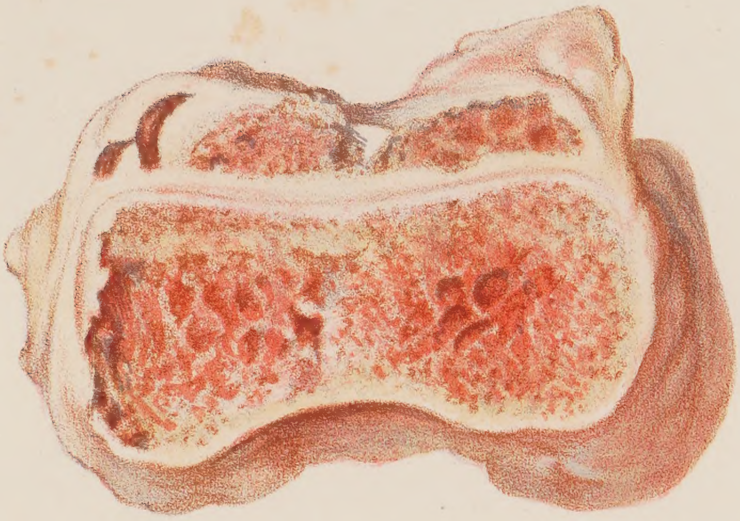

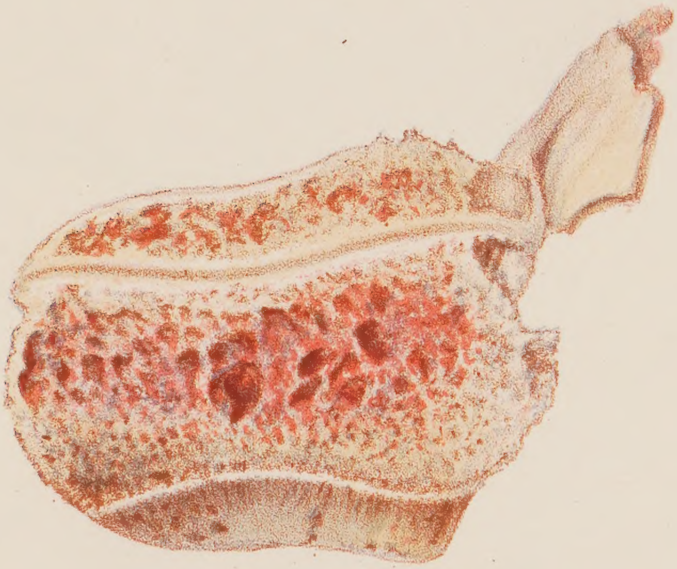

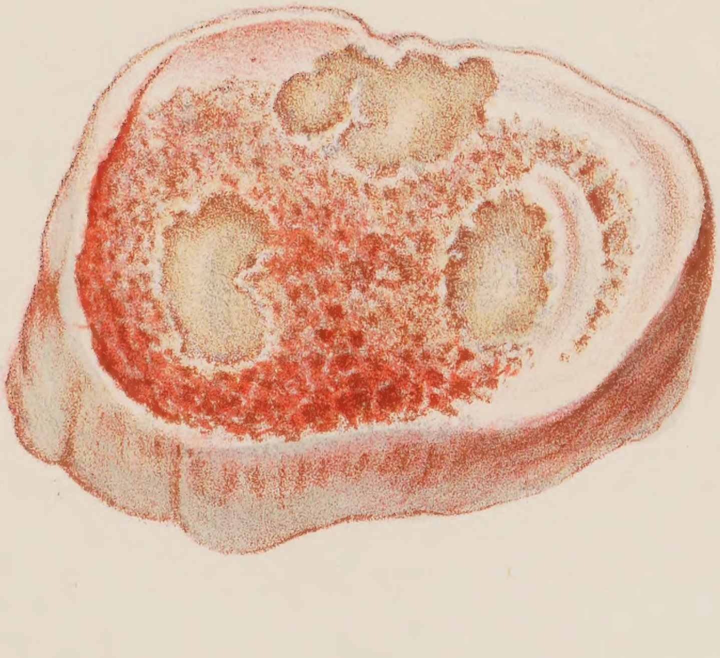

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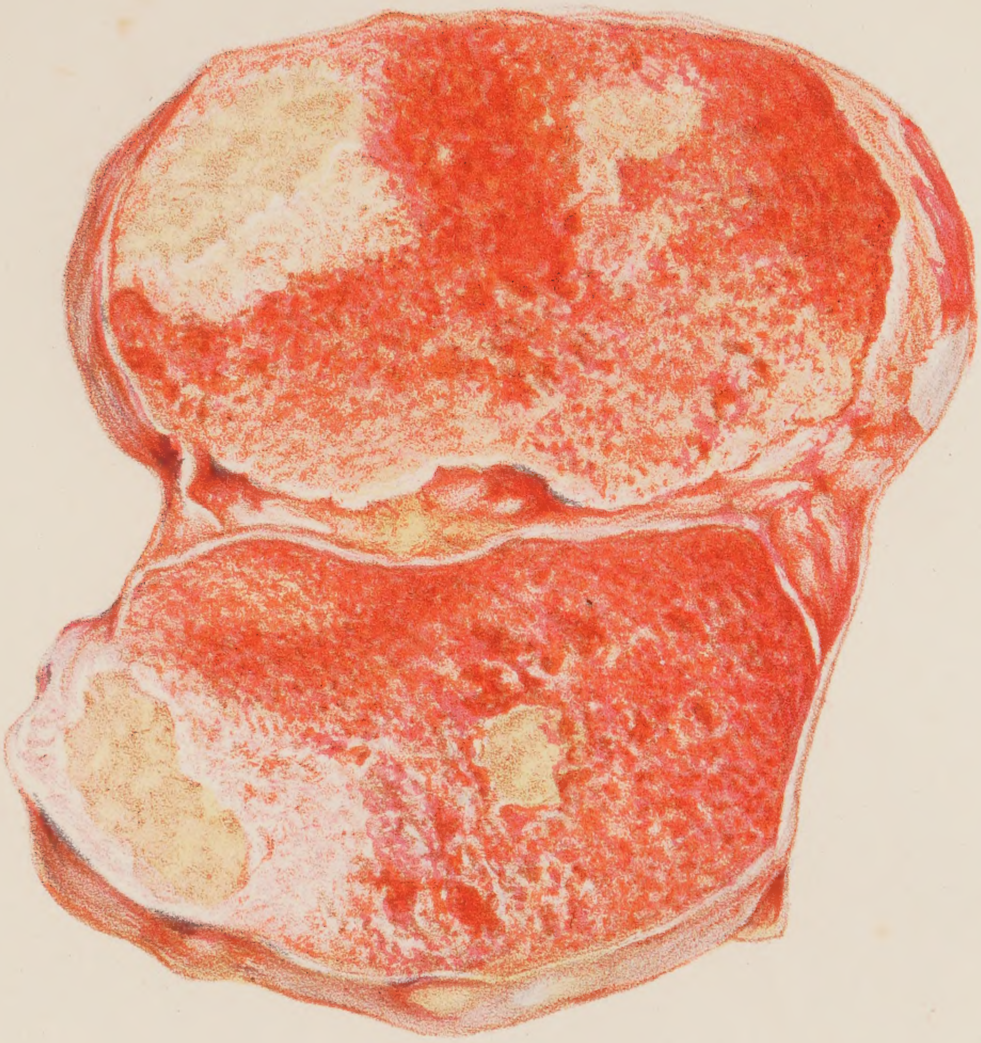

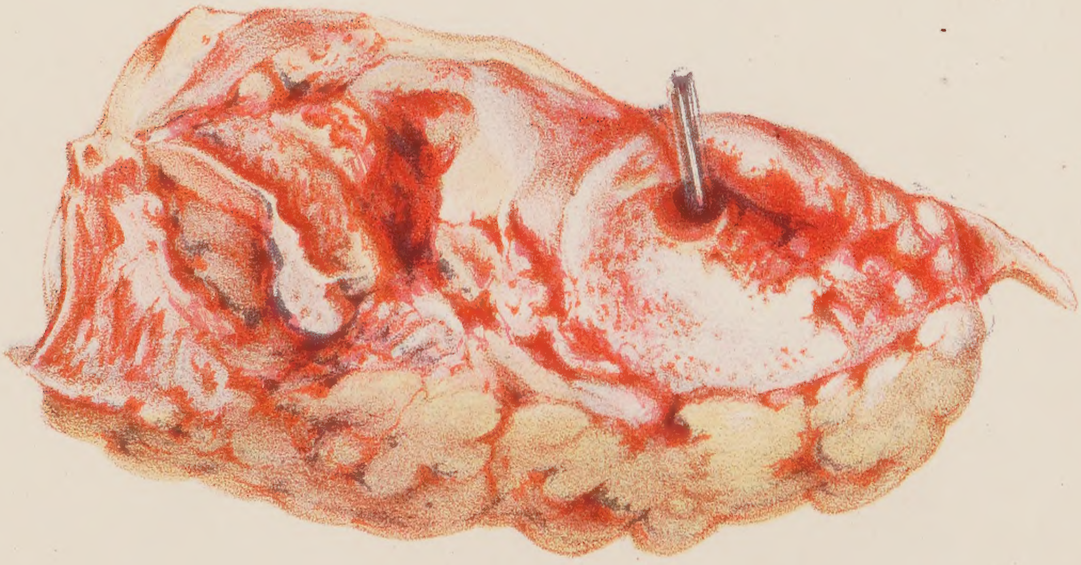

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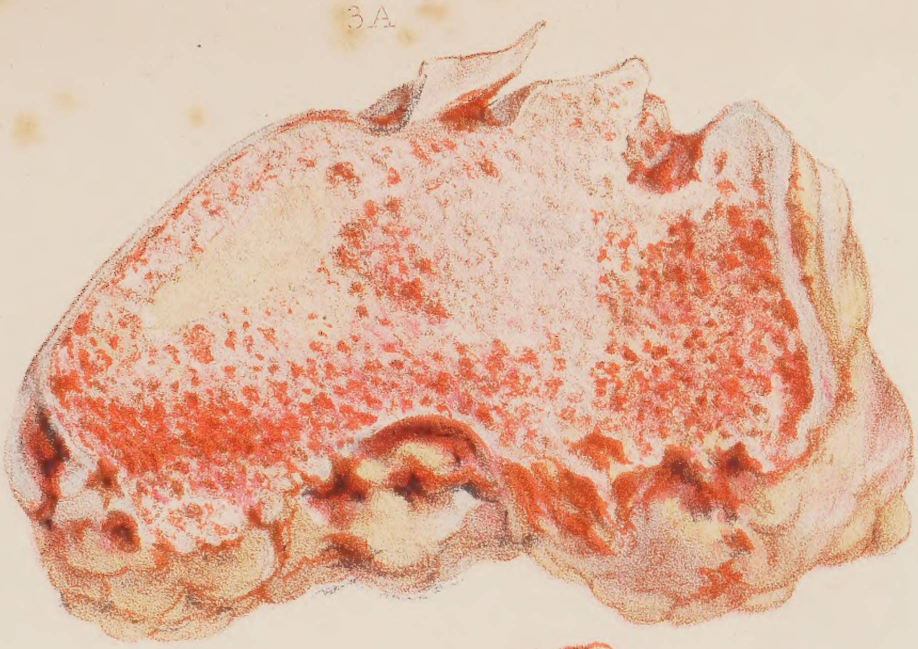

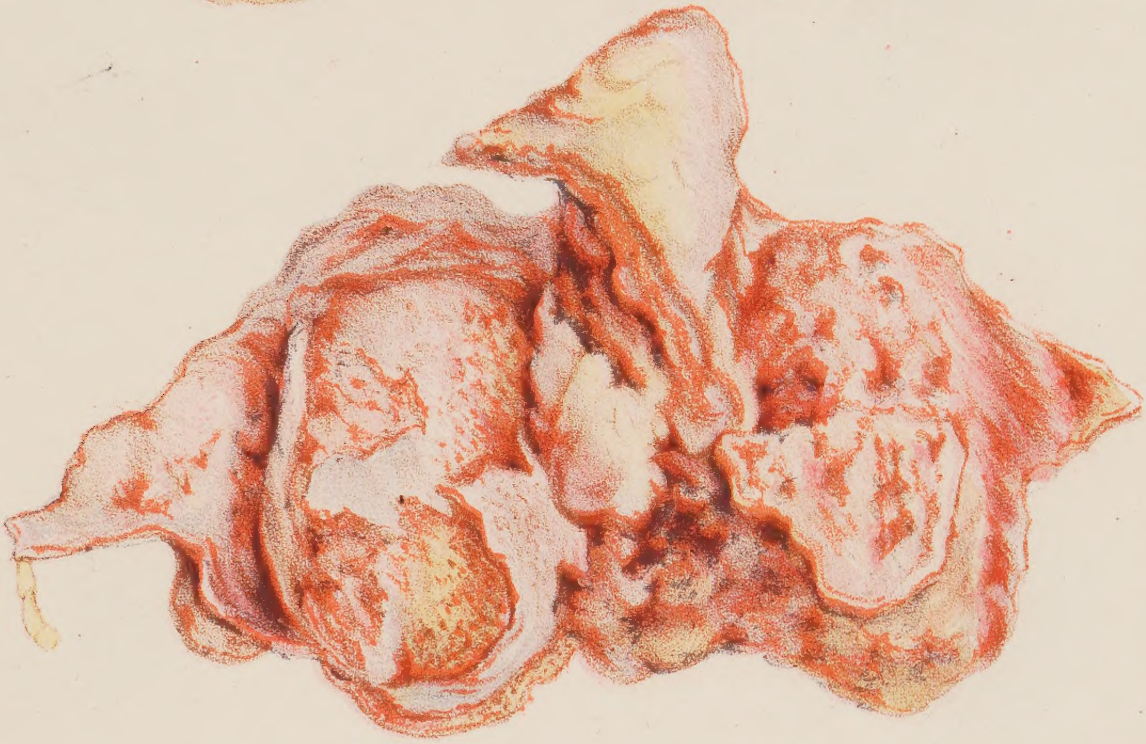

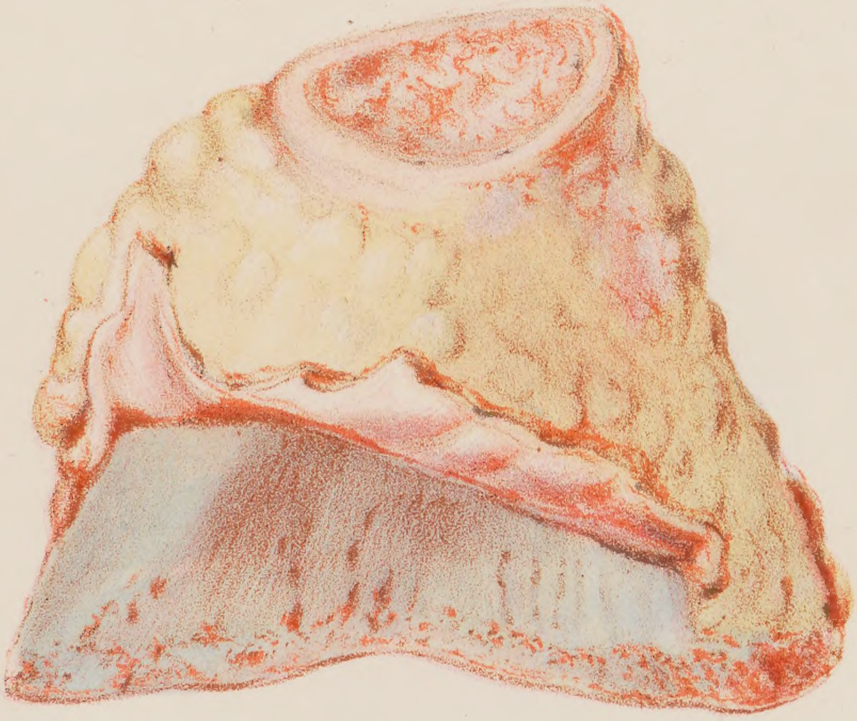

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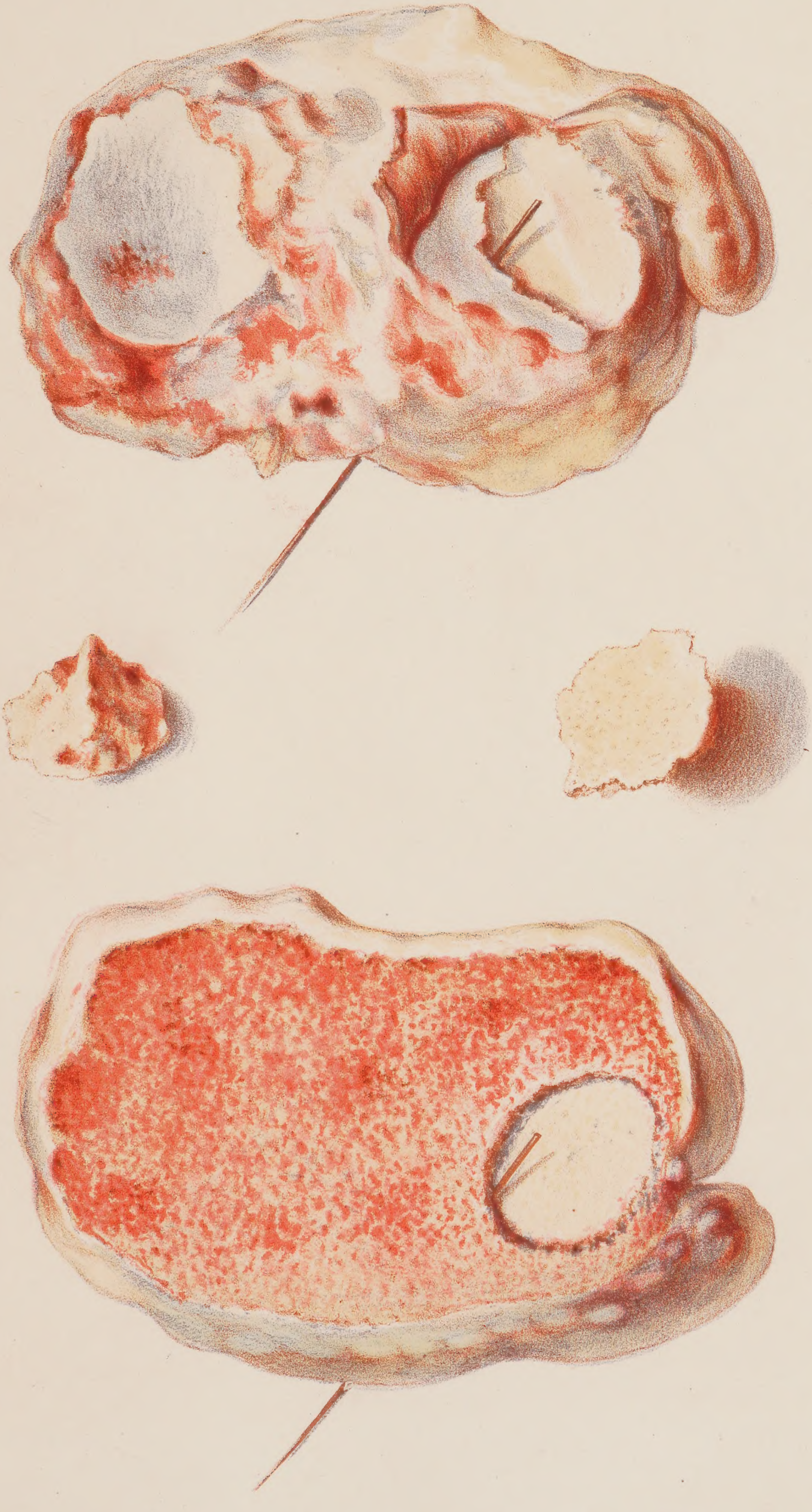

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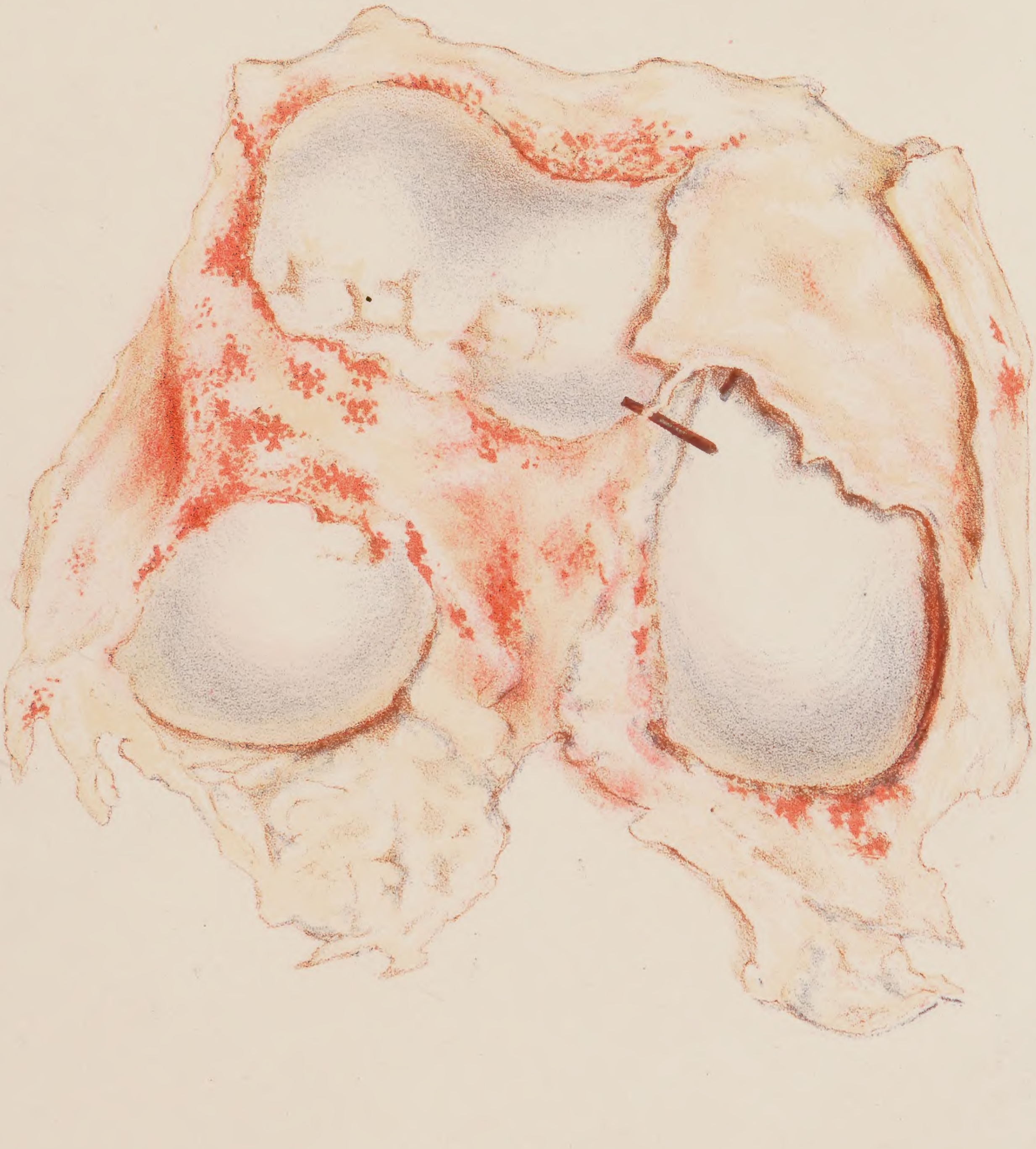

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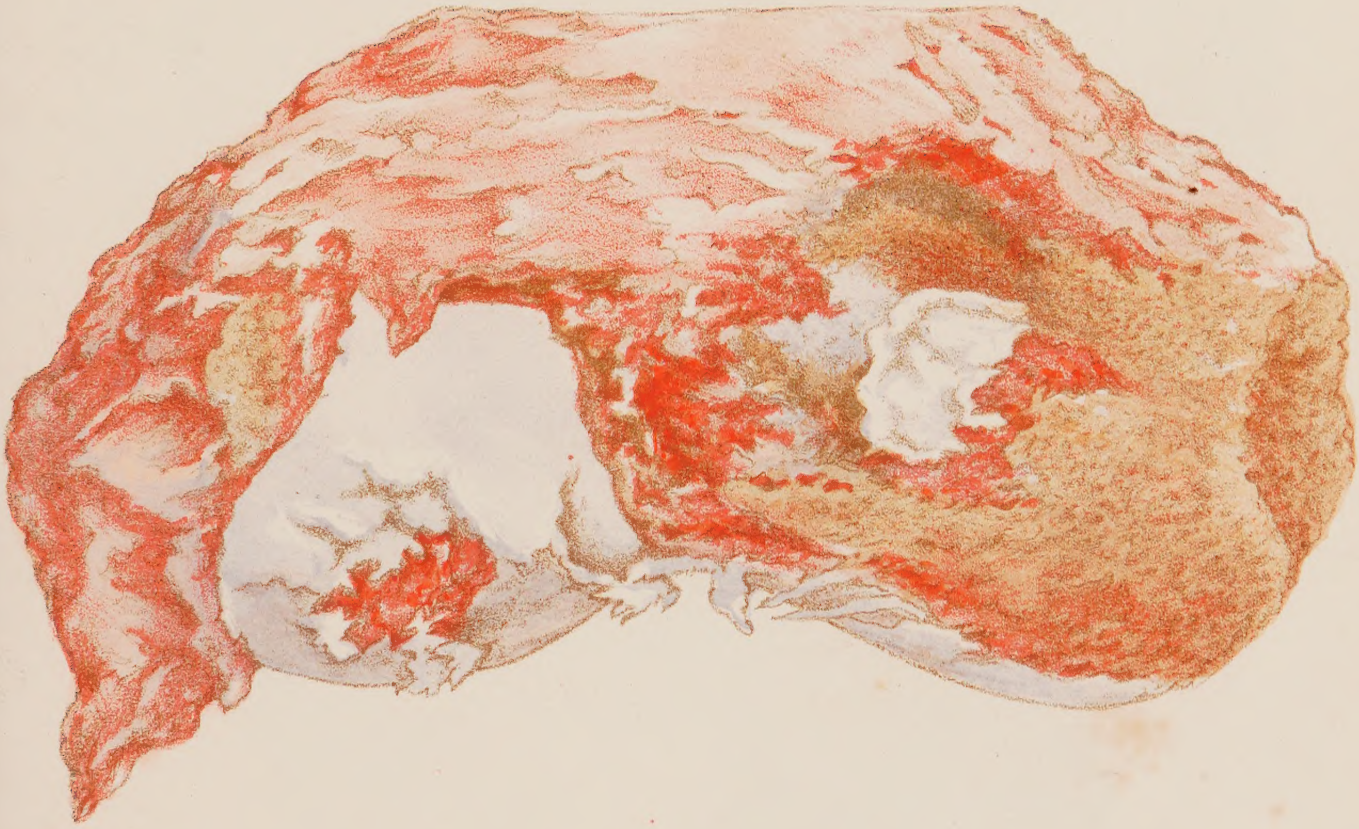

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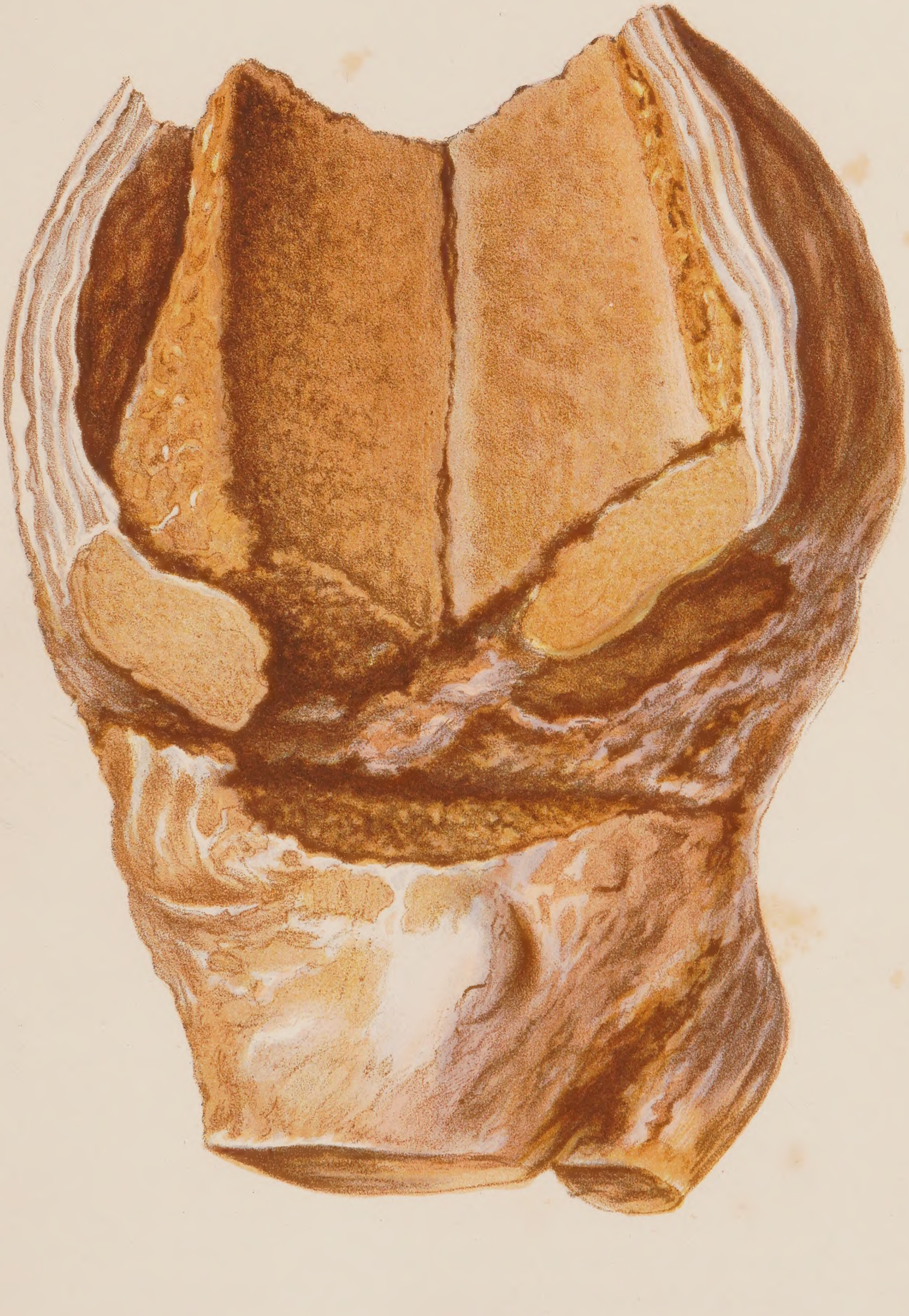

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DISEASE OF THE KNEE-JOINT REQUIRING OPERATION.

PART I.

NORMAL ANATOMY OF THE HUMAN KNEE-JOINT.

The articulation of the knee is the largest, and perhaps, when rightly considered, the most complex of the human body. Its bony parts are composed of the expanded end of the femur, the broad portion of the upper surface of the tibia, and a small flattened bone termed the patella. These various surfaces are maintained in suitable apposition by means of certain fibrous and synovial bands and prolongations, termed ligaments. Lining the interspaces which exist among the irregularities of the various bones composing the articulation, and forming a complete short sac about all the component structures, is a thin delicate secreting membrane—the synovial capsule. In addition, a capsular fibrous membrane more or less completely protects the synovial sac in the interspaces between the ligaments of the joint; and certain tendons, which are either the origins or insertions of muscles, are inserted around the articulation at various parts of the condyles of the femur, the tibiæ and fibulæ. Besides the bony, fibrous, and synovial structures, there exist certain intermediate substances termed cartilages, the presence of which are indispensable to the perfect adaptation of parts, and perfection of movement. These are of two kinds: *investing*—those which cover the ends and surfaces of the articulating osseous extremities; and *interposed*—which are two in number, semilunar in shape, and correspond in size to the head of the tibia, with which they are slightly connected, and serve to deepen its surface for articulation, besides forming a kind of interposed pad or cushion between both bones.

For vascular supply the articulation is dependent on small offshoots from the main arteries of the thigh, ham, and front of the leg,—viz., the anastomatic branch of the superficial femoral, some small branches of the popliteal, and a recurrent branch of the anterior tibial artery.

The nerves supplying the various portions of the joint are derived partially from a distant source, and from large chords which pass downwards in near proximity,—viz., a small branch from the obturator nerve, and certain twigs from both the internal and external popliteal trunks. Investing the entire articulation is the covering integument, which, by reason of its connections with the cellular tissue, admits of considerable and easy movement and elasticity.

Such is a very brief outline of the rough anatomy of the joint; but to understand correctly the various changes which it undergoes when attacked with disease, and its capabilities of reparation, it is requisite somewhat more carefully to investigate certain features connected with its development, mechanical construction, and functions.

MORE MINUTE ANATOMY OF THE KNEE-JOINT.

The adult knee articulation is described by the majority of authors, who have interested themselves in the study of the mechanism of joints, as a ginglymoid or hinge-joint, but it is not a perfect example of the kind; for, says a very practical anatomist: "If the movement at the knee were of the true hinge kind, the whole or one part of the articular surface of the tibia would remain applied against some portion of the condyles of the femur in the flexed as well as in the extended position."* This same anatomist has also shown that, in the several degrees of movement from flexion to extension, the tibia is turned on its transverse axis, possesses a limited sliding movement, and is capable of slight rotation on its vertical axis. A like description has also been admitted by Weber,* while some anatomists have merely alluded to the knee as a hinge-joint, with a slight arthrodial or sliding motion.†

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* A Treatise on the Human Skeleton. By George M. Humphry, F.R.S. 1858.

The first appreciable evidence regarding the development of the human femur is to be obtained at an early period of fœtal life. It is first recognised as a hyaline substance composed of formative cells, which are soon converted into cartilage, and eventually into bone. But it is the development of its lower portion or epiphysis which more particularly claims attention. Although about the fifth week of fœtal existence, ossification commences in the shaft or diaphysis, yet it is not till the last (ninth) month, or just prior to birth, that an ossific centre or point is detected in the lower epiphysis. The conversion of this primary cartilage into true cancellous bone is a very slow process, for it is not till the twentieth or twenty-fifth year that it is complete, and joined by osseous material to the shaft. The same observations are applicable with regard to the development of the tibia, but it is not till a week or two later that an ossific germ is discovered in the diaphysis, and the epiphysis remains oftentimes a full year after birth without exhibiting any signs of a similar nucleus, although, doubtless, the period of such changes varies.‡

The patella, composed of cartilage at about the third month of fœtal life, remains so till two or three years after birth, when an ossific nucleus shows itself in the centre of the bone.

A correct understanding of the process of ossific development of the epiphyseal extremities of the two long bones mainly forming the knee-joint, is of great value and practical interest, as it partly serves to show, as will be hereafter further explained, how, after certain examples of excision of the articulation in young children, the lower limb, so far as the bony structures are concerned, fails to develop itself at a rate corresponding to that which ensues in the healthy extremity.

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* Weber, Mechanik der Menschlichen Gehwerkzeuge.

† Article—Knee-Joint. Cyclopædia of Anatomy.

‡ The Anatomy works of Quain and Sharpey, Humphry, Gray, &c.

It is now well known that up to a certain period of life the development of long bones mainly results from what are termed "osseous centres," or "centres of ossification;" and that these points of development are independent of each other, and that it is not till a general fusion of epiphyses and diaphysis has taken place, that a complete bone is formed; and even then its further development in length continues, not by interstitial growth, but principally through the medium of the cartilage interposed between the two portions of bone, as was long ago experimentally explained by Hunter;* and since, more especially investigated by M. Flourens and others.†

The nature of this junction is worthy of consideration to practical surgeons, as well as to anatomists; for I shall presently quote instances in which the epiphysis was forcibly torn away, and the neighbouring joint so involved that removal became imperative, and where excision was performed in preference to amputation. To enter more minutely into the explanation of the formation of the articular ends of the bones forming the knee-joint by the transition of true osseous material from cartilage, would be foreign to the present purpose. Suffice it to say, that the cellular or cancellated structure which results, is extremely susceptible of diseased action, both of a primary and secondary character; and that it is only on a correct understanding of the true anatomical construction of the parts, that any definite and rational interpretation of many forms of disease can be entertained and treated.

ANATOMY OF ARTICULAR CARTILAGE.

Both the articulating ends of the femur and tibia are covered by a cartilaginous layer which completely invests them. This covering is that portion of fœtal cartilage which has remained unossified and in its integrity. It is connected with the epiphysis by means of an interposed lamella of bone, which possesses a special and interesting structure, for it is through this medium that articular cartilage is by some anatomists believed to be nourished, as it is itself a non-vascular tissue.

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* *Vide* Preparations in Museum of St. Bartholomew's Hospital.

† Théorie Expérimentale de la Formation des Os.

The mode in which nutrition is imparted to articular cartilage has been investigated by many able observers, but with different conclusions.

While some investigators assert that the bony lamella interposed between the shaft and the epiphysis is not perforated by apertures for the transmission of nutrient fluid,* others maintain that the structure is essentially tubular, and that it is through highly minute tubes—the smallest yet described as existing in any human tissue—that nutrition is effected.† I have had the advantage of examining preparations supposed to illustrate this latter view, but I am not prepared to admit the existence of a true tubular character of the lamella. It is probable that the *striated* appearance seen on looking at a thin section of the lamella is due to a specific change in the hyaline matrix, and not really to the existence of minute tubes or cylinders. Although such may be the case, still, as has been well observed, "It is probable that the lamella is permeable by fluids; and that articular cartilage is, in great part, nourished by osmose across it, between the bone and cartilage."‡ Since the researches of Messrs. Tomes and De Morgan, published in the "Philosophical Transactions" for 1853, regarding the minute structure of the bony lamella, little has been added to the histology of the subject.

The thickness of the investigating cartilage of the condyles varies in different individuals; and, apparently, according to circumstances. Dr. Redfern states that he found it varying in thickness on the two condyles, in subjects from twenty-three to eighty years of age, from $\frac{1}{15}$ to $\frac{1}{7}$ of an inch; and on the tibia, existing in about the same proportions.* Kölliker also gives about the same measurements.† These cartilages are, however, thicker in the middle than towards the edges, where they become blended with the periosteum.

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* Organization and Nutrition of Non-vascular Tissues. J. Toynbee, F.R.S. Philosoph. Trans. 1841.

† Nutrition, Inflammation, and Ulceration of Articular Cartilage. R. Barwell. 1860.

‡ On the Minute Structure of the Articular Lamella of Bone. Mr. Hulke, Pathological Trans. 1860.

It is still a vexed question whether any delicate structure invests the free surface of the articular cartilages of the femur and tibia. Heale asserted the existence of a pavement epithelium; but subsequent observers have endeavoured to demonstrate this delicate structure as consisting of a series of minute cells, and not of a strictly epithelial tissue. As yet no nerves or lymphatics have been shown to render this structure either sensitive or absorptive. A more detailed account of the nature of articular cartilages is foreign to the present purpose, but will meet with further elucidation at a future period of this essay.

OF THE SYNOVIAL MEMBRANE.

Investing all the structures which enter into the composition of the knee-joint is a thin delicate semi-transparent membrane, the principal utility of which is to secrete fluid for the due lubrication of the articulation. It is connected by a very fine areolar tissue to the surfaces of the ligaments, and to the margins of the articular cartilages at their junction with the bone. The opposed surfaces are smooth and glistening, and covered with a layer of tesselated epithelium. The connective tissue is highly endowed with blood-vessels.‡

The membrane itself possesses no glands as far as can be ascertained, but is not rich in nerves. Various folds, or doublings, which are styled ligaments, are found in connection with this tissue: such as the "ligamentum mucosum," and the "ligamenta alaria," &c.

In the adult human knee-joint the most careful investigators have failed to demonstrate that the synovial tissue extends over the surface of the articular cartilage, although it is said to do so before the knee-joint is much used and attrition has worn it away. Mr. Toynbee has proved its prolongation over the articular cartilage of the fœtus;[*] but, as already observed, its existence is notwithstanding doubted by those who have closely investigated the point.[†] There is no doubt, however, that for a very limited distance near the thin margins of the cartilages the synovial structure can be definitely traced, and the vessels supplying it traced ending in a looped arrangement. I am, however, convinced that I have more than once traced a prolongation of the membrane over the cartilaginous surface, although I have failed to do so on several occasions; but I am the more impressed of the fact of its existence, if not always, at least sometimes, because in a diseased state of the articulation it can, with care and a delicate dissection, be now and then demonstrated. Corroborative of this somewhat negative assurance, Mr. Bryant, in his recent work on the Joints,[‡] quotes a most instructive case of disease of the knee-joint in which the existence of a true synovial prolongation—distinct from the false, pulpy membrane, the result of inflammatory lesion—was clearly traced extending across the articular cartilage. In the normal and active state of the synovial membrane the secretion appears to consist of a slightly albuminous fluid, containing mucus and a few salts in solution; but when in an inflamed and diseased condition, the character of the synovia is more or less altered.

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* On the Thickness of Articular Cartilages. P. Redfern, M.D.

† Kölliker. Manual of Histology. Translated by Sydenham Society.

‡ Todd and Bowman, op. cit., "A great number of blood-vessels." Kölliker, op. cit., "Not very numerous vessels or nerves."

OF THE INTERARTICULAR CARTILAGES.

The interarticular, or semi-lunar fibro-cartilages, as they are sometimes termed, are two in number, and rest by flat surfaces on the two facets of the head of the tibia corresponding to the convex surfaces of the condyles of the femur.

They are thin and concave in their centres, but thick and convex at their margins. Their utility has been already alluded to. Examined microscopically, these menici are found to contain white fibrous tissue, entangling in its meshes cartilage cells in varying proportions. Nutrition is derived through the medium of the adjacent synovial membrane. No nerves have, as yet, been discovered permeating their surfaces. From their low organization, they are freely acted upon in both acute and chronic diseases of the articulation.

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[*] Philosophical Trans. cit.

[†] Barwell, &c., op. cit.

[‡] On the Diseases and Injuries of the Joints. Thos. Bryant. 1859.

TENDONS AND FIBROUS EXPANSIONS ABOUT THE KNEE-JOINT.

It has already been stated that the bony portions forming the knee articulation are held together, and their movements allowed by certain tendinous and ligamentous expansions.

It will be advisable to review these somewhat in detail, so that it may be more readily explained how far they may be involved in excision of the joint.

The first tendinous insertions in relation with the lower end and condyles of the femur which are liable to be interfered with in the operation, but then only when a considerable portion of the extremity of the thigh bone is removed, are the insertions of the gastronemius muscle, the two bellies of which take origin from two flat strong tendons, the inner and larger one from the upper and back part of the inner condyle, and the outer from the upper and back part of the external condyle immediately above the origin of the popliteus muscle.

If the origin of the outer head of the gastronemius be disturbed, it almost of necessity follows that the strong flat tendon of the popliteus, which takes root from the deep depression on the outer side of the condyle and posterior surface of the femur, is likewise disturbed.

Provided that the entire block of the condyles is not removed, the plantaris muscle, which arises partly from the femur just above the external condyle, is not interfered with.

Should the whole of the internal condyle be taken away, the insertion of the internal portion of the gastronemius, which is by a rounded (somewhat) tendon, is also liable to be divided, and also a small portion of the general insertion, which reaches to the spot where the rounded tendon is inserted.

In connection with the head of the tibia, the following membranous structures may be interfered with in removal of the joint, but the point at which they are divided greatly depends on the nature of the incisions and extent of bone removed.

Into the posterior part of the inner tuberosity of the tibia, beneath the lateral ligament, is inserted the main portion of the broad expansion of the semi-membranosus muscle; and if three-quarters of an inch or one inch of the bone be removed by operation, it is to the cost of the inserted structure. Although a greater or less portion of the tendinous expansions of the sartorius and gracilis muscles may be divided in the lateral incisions, still it is not probable, unless indeed a very thick section of the head of the tibia be required, that they will, in general, be materially molested. The same observation applies to the position and liability of the tendon of the semi-tendinosus muscle to be disturbed.

Provided that the connections of the patella with the tibia be severed, the ligamentum patellæ by its division will allow the conjoined tendons of the rectus femoris, the two vasti and crursi, to be disengaged.

If the section of the head of the tibia be somewhat considerable, *i.e.* at least half an inch or three-quarters of an inch, it is highly probable that the tibio-fibular articulation will be interfered with, and consequently the tendon of the biceps flexor curis, at its insertion into the outer part of the head of the fibula, separated.

LIGAMENTS IN RELATION WITH THE KNEE-JOINT.

The bony parts forming the knee-joint, as before stated, are held together by certain fibrous ligaments which have their points of insertion in such portions of the femur, tibia, and fibula, as are more or less generally implicated in the operation of excision.

These various ligaments may be briefly noticed.

Those situated without the articulation consist of—

The anterior ligament, or ligamentum patellæ ;
The posterior, or ligamentum Winslowii ;
An internal lateral ligament ;
Two external lateral ligaments ; and
A capsular ligament, or investment.

Beneath this latter ligament, and in direct relationship with the internal portion of the joint, will be found two ligaments termed crucial—one, anterior or external ; the other, posterior or internal, and a transverse and coronary ligament.

The synovial ligaments (improperly so called) have already been noticed. The anterior ligament has been described. The posterior is the structure of most importance for the practical surgeon's consideration ; for it is this firm, tense, and resisting band which enables the articulating extremities of the femur and tibia to be sawn away, without incurring the risk of disturbing or wounding the large popliteal vessels and nerves which lie in such close proximity to the back portion of the joint. It consists of a broad, flat plane of fibres, extending from the internal tuberosity of the tibia to the outer condyle of the femur, closely united with the tendons of the gastronemius, popliteus, and plantaris muscles. Its direction is oblique, and for much of its strength it is indebted to a portion of the tendinous expansion of the semi-membranous muscle.

The internal lateral ligament, stretching from the inner tuberosity of the femur to the inner tuberosity of the tibia, is of interest when considering the nature of certain diseased conditions of the knee-joint, which readily allow the displacement of the head of the tibia, and consequent relaxation of this structure.

The two external ligaments stretch from the outer tuberosity of the femur to the head of the fibula—the longer and external to the outer part of the head, and the shorter one to its spinous process.

All these three last-named ligaments are completely divided at an early stage of the operation, but at what particular point is uncertain, as the division is influenced by the nature of the tegumentary incisions.

The crucial or cross ligaments, situated within the cavity of the joint, if not destroyed by disease, need division in the operation of excision, and are the last links which hold together the portions of bone to be removed.

The transverse and coronary ligaments need little attention in relation with the operation of excising the knee-joint.

PART II.

A SKETCH OF THE VARIOUS DISEASED CONDITIONS OF THE STRUCTURES COMPRISING THE KNEE-JOINT, WHICH UNDER CERTAIN PHASES DEMAND A RECOURSE TO AMPUTATION OF THE THIGH OR EXCISION OF THE ARTICULATION.

All the structures composing the knee-joint are liable to assume a diseased action both individually and collectively, but it is comparatively rare that the surgeon is called on to adopt such an imperative measure as amputation or excision before several of the component parts have shown a decided departure from their normal condition and functions.

To understand thoroughly the nature of extensively diseased states of the knee articulation, it will be advisable to pass in review those abnormal conditions of individual tissues which, if progressive, lead to the necessity of a capital operation.

The following arrangement of the various disordered conditions into which the different component structures of the knee-joint may degenerate, and lead to complete or partial destruction, will, perhaps, be found as convenient as any that can be offered, especially if it be remembered, that general experience shows that diseased action is most frequently met with involving the structures, in the following order.

I. DISEASED CONDITIONS OF THE SYNOVIAL MEMBRANE.

This membrane is more frequently the seat of disturbed action than any other joint constituent. From its anatomical structure and position, it is rendered exceedingly susceptible of inflammatory changes, which are often common causes of extensive and irremediable derangement.

Acute inflammation may arise independently of any appreciable cause, but it more frequently depends on one that can be more or less readily traced. Whatever the origin of the lesion, the earliest symptom consists in swelling of the entire joint, but coincident with this increase in size is pain referred to some particular point, although invading the whole surface. Both these indications depend not only on a merely increased vascularity, but on a more or less turgid and congested condition of the tissue, with exudation of an altered secretion. If this stage of inflammatory mischief be not checked, a still more marked change soon takes place in the vital functions and organism of the membrane. The tissue becomes still more turgid, thickens, and shows a disposition to soften and break down. This accession in thickness is, however, one of the most prominent alterations; and owing to this somewhat mechanical metamorphosis, the secretion from its surface partakes of the distinctive characteristics of fibrinous exudation. Should resolution now occur, it is possible that adhesions may partially or entirely obliterate the joint cavity, so far as the synovial membrane is concerned, and an impaired, but still useful, limb be saved. Unfortunately, however, far more formidable changes may accrue, and culminate in destructive suppurative action, which, in all probability, will lead to serious implication of adjacent structures, which hitherto have only sympathetically suffered. Suppuration within a joint cavity is always a very serious complication, for it is accompanied by an increase of the most formidable symptoms, both local and constitutional. When pus has formed within the knee-joint, as the result of acute inflammation, it may be discharged either artificially, or evacuated by the surgeon. In whatever way it finds exit from the articulation, the damage its presence has caused is frequently of the most serious character. Under these circumstances, it commonly happens that the only course open to afford relief is the resort to a capital operation. It will be seen how far successful is the adoption of either amputation or excision for the relief of acute suppuration in the knee-joint, when criticising the comparative value of the two proceedings. It may, however, be here remarked, that the extent and character of the suppurative stage is, as a rule, greatly influenced not only by the treatment which may have been adopted during the progress of the mischief, but by the specific nature of the inflammation, the constitutional condition and age of the patient, and the influence of external agencies. The extent to which the diseased action has spread is also a point of very considerable importance, for the nature of the symptoms will very frequently depend on the complete or partial inclusion of the various component structures of the joint. So long as the inflammatory mischief, no matter in what stage, is confined to the synovial membrane, the danger to life, and even to the articulation, is far less than when the ends of the articulating bones are included; for, as will be presently explained, the necessity for a capital operation is oftentimes solely, or nearly so, determined by the extent to which the cartilages, ligaments, and bones are believed to be implicated.

Although acute inflammatory lesions, whether idiopathic in their origin, or arising from mechanical injury, or from diseased action,— such as blood poisonings, including pyæmia, puerperal fever, rheumatic fever, &c.—may so far progress as to arrive at a suppurative crisis, still, fortunately, such advance, under favourable circumstances and judicious treatment, is the exception and not the rule.

The acute character of the inflammation, skilfully combated at an early period, may subside without inflicting material damage to the integrity of the articulation, into a subacute and chronic form. And here it may be remarked that the occurrence of suppuration as a consequence of acute inflammation of the synovial membrane, according to the statistics I shall offer regarding the operation of excision of the knee-joint, has seldom demanded the adoption of the proceeding; or, in other words, that surgeons have not thought it advisable to excise the vitiated articulation in preference to removing the limb by amputation. On this ground, I shall not enter more fully into the detail of destructive inflammatory lesions of the joint, but reserve any additional observations till the question of the advisability of the two operations is more immediately discussed.

II. SUBACUTE INFLAMMATION OF THE SYNOVIAL MEMBRANE.

Intermediate in urgency of symptoms and degree of shock and danger to the patient, between the acute affection just described and one of a still more subdued character, to be presently adverted to, is a subacute inflammatory condition of the synovial membrane. Of all joint affections it is universally admitted to be amongst the most common. It attacks individuals of all ages, but is more particularly met with in youth and early manhood. Both sexes are alike subject to its attacks. It results from causes which have both a constitutional and local origin; and, as a rule, if taken early under treatment, before any extensive alteration in the synovial tissue can have ensued, is easy of amendment, or complete cure.

To the eye of the experienced practitioner, its recognition is generally unaccompanied with difficulty—the enlarged and peculiar bulging condition of the joint affording tolerably conclusive evidence of the character of the disease. In addition, the sensations of the patient, and the amount of constitutional and local disturbance, will serve to point to the true nature of the affection. Although the early stages of the disease may often be arrested, still, from peculiarities of circumstances, advance of the morbid process may lead to further and more chronic mischief, and eventually to complete, or partial, destruction of the articulation. When once the inflammation extends to adjacent component structures—such as the cartilages, articulating bones, fibrous and ligamentous tissues—the affection assumes a more momentous importance.

The various changes which then ensue will be more fully considered when treating of still more chronic action destroying the integrity of the joint. They are identical in kind, though modified in degree, and admit the self-same destructive processes. In practice, a clear distinction between subacute and chronic action is extremely difficult of correct delineation, and I shall, therefore, defer a more precise notice of the principal features of subdued inflammatory states of the synovial tissue, till the subject of chronic synovial disturbance meets with consideration. Suffice it, however, to say that a spread of the synovial disturbance not unfrequently leads to the compulsory performance of an operation, which has for its aim the permanent and complete removal of all disease.

III. CHRONIC INFLAMMATION OF THE SYNOVIAL MEMBRANE (CHRONIC SYNOVITIS).

A low, tardy, and subdued form of inflammatory action is very prone to affect the synovial tissue of the knee-joint, arising from some known local and constitutional cause, or originating in an obscure manner. It is not, however, always easy to light upon the cause of the mischief, and the practitioner will often find himself foiled in his endeavours to trace the origin of an attack. Swelling of a definite form is one of the earliest and most clearly-defined symptoms; while the absence of pain, and even tenderness, is often so remarkable, considering the amount of apparent mischief, that their non-existence is sometimes sufficient to deceive the surgeon and patient as to the exact state and progress of the disease. I believe that there are few surgeons who will not readily admit that pain is a most equivocal and deceptive accompaniment of joint diseases. I have over and over again been deceived as to the nature and extent of diseased action invading the knee-articulation, because I have looked upon the presence or absence of acute pain as a chief diagnostic feature; and in recording instances in which excision has been performed, it will be shown that extensive destruction has often taken place in the joint without the occurrence of any very considerable pain or annoyance.

As the synovial membrane is, in general, the only tissue that is at first implicated in this limited form of inflammation, it may be well to see what are the changes which it undergoes. The nature and degree of increased vascular derangement is, as might be supposed, dependent on the cause of the mischief and constitutional condition of the patient. The earliest change in the synovial tissue is generally believed to be a suspension (partial or complete) of the secretive function. As the inflammatory disturbance proceeds, not only, however, does the secretive function of the membrane return, but the synovial fluid is characterised by changes which plainly denote an abnormal condition. Instead of the fluid remaining clear and transparent, and moderate in quantity, it increases in amount, and becomes opaque, more or less tinged with bloody serum, in accordance with the amount of vascular derangement. If the tissue be now examined, it will appear thickened, pulpy, soft, and injected with blood-vessels. The exudation from these vessels is oftentimes so extensive that a distinct false membrane is rapidly formed, which, varying in thickness, lines the surface of the parent tissue, or moulds itself on the smooth plain of the articular cartilage. Plastic in character, it soon undergoes partial organization, provided it be not re-absorbed. This formation, sometimes delicately covering the cartilages, is not unfrequently mistaken for a prolongation of the true synovial membrane, but a very slight examination will at once show that it is a new and distinct formation. These observations are well illustrated by referring to a drawing (*Plate* 5) taken from a preparation in the Museum of St. Thomas's Hospital.

But it may happen that, instead of the exudation from the inflamed membrane being plastic and fibrinous, it may partake of the characters of purulent secretion. Such an untoward event is always to be dreaded, as the presence of pus in a joint cavity is fraught with considerable danger. Should this condition obtain, it is highly probable that adjacent structures may assume a diseased condition. The cartilages exposed to the contact of a purulent and unnatural secretion become softened, and undergo a series of changes, more particularly to be described. The articulating ends of the femur and tibia, deprived of their protecting coverings, are exposed to the corroding influence of the purulent fluid ; consequently they inflame, ulcerate, and undergo a process of complete destruction. In this way not only do the ends of the bones become carious and disintegrate, but undergo a more determined destruction,—a true necrosis. It is not uncommon for the cancellous structure of the expanded extremities of the two long bones to be included in the inflammatory disturbance at certain points, at some distance from the seat of original mischief. Limited abscesses may form, and having caused destruction to that portion of bone in which they are seated, lead to still further mischief by their contents gravitating towards the joint cavity. The articular cavity becomes filled with pus, mingled with the debris of cartilage and bone. Around the joint, ere the mischief has so far advanced, fibrinous thickening and induration has probably taken place, but with the extra irritation abscesses commence to form. With the thinning of the integument that ensues, distension of the joint, with the purulent and other matter, attains to such an extent, that the ligaments becoming lax, or destroyed, allow deformity of the joint. The muscles of the thighs—the hamstrings—acting with little or no opposition, soon disturb the tibial portion of the articulation, by displacing more or less the position of the tibia. In addition, there exists, as it were, a natural tendency for the bone to assume an angle more or less acute with that of the thigh bone, by which a position is assured to the sufferer of the least possible annoyance. The collection of fluid within the joint having found an exit through the integuments, through the instrumentality of Nature, or the surgeon's knife, resolution, or still further mischief, may ensue. If reparation succeeds to processes of destruction, it is probable that a useful limb may be obtained ; but it is always questionable to what extent the restorative powers may be invoked. Even if a useful limb do not result, a cessation of all serious mischief may take place, and with the help of surgery an ultimate good extremity may be obtained. Unfortunately, the processes above described are fraught with constitutional disturbances; and to such an extent does the system sometimes sympathise, that all the efforts of the surgeon are insufficient to save the patient without adopting some decisive surgical interference,—as, either freely opening the affected joint, and thereby affording a free exit for the pent-up material; amputating the diseased organ, perchance, with a sound and healthy leg and foot; or excising the vitiated articulation, and retaining all parts below the actual seat of mischief.

Although chronic synovitis may run such an extreme course, yet, as a rule, it is rare for it to do so till repeated attacks of low inflammatory mischief have rendered the articulation incapable of further resistance. When once a knee has suffered from one or two invasions of chronic inflammations, it becomes, as Sir B. Brodie has well shown, abnormally susceptible to repeated attacks, till at last one more severe than any of previous occurrence, leads to destruction by the processes described. The period over which repeated attacks of chronic inflammation may extend without leading to complete destruction of the articulation, varies. I have under my notice at the present time two patients in whom this particular condition of the synovial membrane of the knee has lasted for many years—in one for over nine, and in the other for nearly seven years—without exhibiting any tendency to advance to suppuration, or extend to neighbouring structures; while, on the other hand, I shall adduce instances in which removal of the joint was necessitated at a comparatively early period.

It has already been hinted that attacks of chronic inflammation are more or less influenced by certain constitutional conditions, which may be included under the heads of the gouty, the rheumatic, and the scrofulous. It is seldom, if ever, that the surgeon is called upon to resort to very extreme and direct surgical means for the removal of a gouty articulation. It is also a question if the rheumatic diathesis so far influences synovial inflammations, as to render ultimate measures of even ordinary necessity. On the other hand, the scrofulous habit exercises a most material and direct influence on inflammatory processes taking place within this special joint. So marked is the influence of scrofulous taints upon inflammatory derangements of the synovial tissue, that there is no difficulty in describing the results it produces under a distinctive head—"scrofulous chronic synovitis;" and although many authors are inclined to look upon the affection as one strictly of a degenerative type, and arising independently of vascular derangement, I am induced to believe that it very commonly partakes, at a very early stage, of distinct inflammatory action. Many cases of this affection have been under my care during various periods of time, and each individual one has served to strengthen the opinion I have given. If such be not the case, I am at a loss to reconcile the various symptoms presented at an early period in the history of the affection, with those resulting from more determined and simply degenerative processes. Indeed, I believe that future observations will tend to show a very close, if not positive, analogy between pulpy degenerations and truly slow and chronic inflammations of synovial tissues. In whatever light we consider this special form of synovial disturbance, its obstinacy to treatment must be admitted. The disease once established is too often progressive, and leads to the most unfortunate results. The cartilages in the process of time disappear, and allow the ends of the bones to be exposed to the action of, perhaps, an already secreted pus. Ultimately the articulation is destroyed; and provided sufficient repair does not take place, the surgeon is compelled to resort to an operation for the removal of the disease, and especially so if the constitutional disturbance runs high. In reviewing the various cases in which excision of the knee-joint is required, I shall be able to point out some features of practical interest connected with this common and formidable disease.

IV. PULPY AND GELATINAFORM DEGENERATIONS OF THE SYNOVIAL MEMBRANE.

Previous to the time when Sir B. Brodie first commenced his valuable researches on the pathology of diseased states of the joints, all affections in which the synovial membrane was involved were indiscriminately termed inflammatory. This distinguished surgeon, however, showed that the synovial structure of the knee articulation was susceptible of a special disorganization which could not properly be considered of an inflammatory nature, although it occasionally followed on vascular derangement. This morbid change of anatomical character consists in the degeneration of a portion or the whole of the synovial tissue into "a thick, pulpy substance of a light brown, and sometimes of a reddish-brown colour, intersected by white membranous lines. As the disease advances it involves all the parts of which the joint is composed, producing ulceration of the cartilages, caries of the bones, wasting of the ligaments, and abscesses in different places."* The incurable character of this affection, occurring most frequently about adult life, is attested by all surgeons; and although it may exist for a considerable period before seriously involving the integrity of the joint, and distressing the patient, still eventually, in all probability, destruction of the articulation will ensue.

The earliest indications of the existence of this special degeneration, essentially a fibro-gelatinaform one, is a somewhat diffuse, though not very prominent, swelling of the articulation. When this swelling is manipulated, an elastic sensation will be apparent, simulating, in some respects, true fluctuation, but readily distinguishable from such. The general form of the swollen joints, and the absence of bulging at those parts which are rendered so prominent in chronic synovitis, is held by many as plainly indicative of the disease. I cannot, however, admit from my own experience that a positive deduction can, as a rule, be drawn from the peculiar sensations afforded by manipulating the swollen articulation; for I have, on more than one occasion, seen joints removed on account of supposed pulpy, gelatinaform degeneration, which has subsequently been found to consist of a more simple and inflammatory state of the synovial membrane. There is, however, to my appreciation, a more constant and to-be-trusted symptom,—viz., pain, which is generally of a special kind, gnawing and constant; although, it must be admitted that, in the early stage of the disease, it is not a very prominent indication. In running its course the constitutional symptoms may be more or less severe, but in general, till the occurrence of suppuration, they are not sufficient to create alarm. Suppuration having taken place, it is highly improbable that the cartilages will escape destruction, and the bones remain unaffected. In a word, the progress of the disease having included the cartilages, &c. &c., the process of destruction and its accompanying symptoms are analogous to those exhibited by other forms of disease previously described. When destruction to the joint has resulted, and insufficient reparation has failed to render the limb of utility, operative measures may become advisable; and it will hereafter be considered whether amputation, or excision of the vitiated articulation, is the more advisable operation. Although little doubt can remain on the mind of the surgeon as to the adoption of decided operative measures, when the disease has advanced to a highly dangerous stage, yet there are some practical and experienced surgeons who recommend, even in a very early stage, the speedy performance of an operation. I cannot myself lean to this practice, for I am sure I have seen amputation resorted to when a longer and fairer trial of milder remedies might have been given with apparent advantage. The further consideration of this affection may with propriety be deferred till more particular allusion is made to the causes which necessitated removal of the joints in those instances which will be presently submitted.

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* Pathological and Surgical Observations on Diseases of the Joints. By B. C. Brodie, F.R.S. 1818.

V. DISEASED CONDITIONS OF THE ARTICULAR CARTILAGES.

From what has been already observed with regard to the advanced stages of synovial diseases, it will be readily understood how the articular cartilages are so frequently included in the morbid action which lays waste the integrity and functions of the articulation. Having considered, in a former part of this essay, the anatomical formation of articular cartilage, and the mode in which it is generally supposed to be supplied with the elements of nutrition, it will now be convenient to take a cursory glimpse of the various states into which these peculiar bodies are liable to degenerate. It has been stated that healthy articular cartilage, at least so far as research has shown, is devoid of blood-vessels and nerves; and, therefore, it is but right to conjecture, even before adverting to proof, that in certain forms of articular mischief there is complete absence of any decided vascular derangement and pain, and consequently extreme difficulty must always exist in rightly understanding the nature of the cartilaginous disorganization.

Prior to the time when minute pathological anatomy became a study, it was customary to speak of the various morbid changes which ensue in articular cartilage under the familiar name of *ulceration;* but since, as before observed, its structure has been demonstrated to be devoid of blood-vessels, such nomenclature has given way to more exact phraseology; so that by the aid of the microscope we are now enabled to speak definitely of the different changes which really do take place. For the first clear insight into the anatomy of articular cartilage we are indebted to the labours of Goodsir, Toynbee, &c.; for, before the first-mentioned anatomist showed that the disintegration of these structures is accompanied by changes in their minute organization, which cannot be accounted for on physical principles, and must be the inherent though perverted nutritive activity in the tissue itself, a very unsettled notion was entertained of their function and means of destruction. Mr. Liston supposed that in a diseased condition blood-vessels might be traced permeating the structure of articular cartilage; and stated that in several instances he found them running in straight lines from the injected membrane of the bone into the cartilage, and, by joining at their further extremities, forming long loops.*

This condition, Kölliker asserts, however, is certainly nothing more than the normal vessels of cartilage, which may be very beautifully displayed in individuals eighteen years of age.†

To explain the term *ulceration* as used by many of the most recent and intelligent writers on joint diseases, it will be advisable to refer not so much to my own views on the subject, but to draw from the fountain-head such information as may serve to show that many morbid processes which ensue in articular cartilage are due to degenerative changes dissimilar in many respects to those which are usually denominated ulcerative.

The late Mr. Aston Key, who paid particular attention to the subject of joint diseases, believed that articular cartilage became disintegrated by means of a peculiar condition assumed by the synovial membrane—in fact, by a fringed, fimbriated, vascular tissue which formed as the result of inflammation, and caused the absorption of the cartilage.‡ Mr. Goodsir has, however, shown that this membrane, or false tissue, is the result of prior disease, but that it will materially modify the process of destruction.§

With regard to this so-called ulceration, Dr. Redfern clearly observes that the process in cartilage and other tissues is exactly the same, if we regard merely the actions of the essential elements of the textures, although the points of dissimilarity consist in the non-production of inflammatory products, as exudation and purulent secretions, and the absence of all painful sensations.|| But the process of destruction, pathologically considered, consists in a special granular dege-

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* Medico-Chirurg. Trans. Vol. xxiii. 1840.

† Kölliker, op. cit. 1853. Vol. i.

‡ Med.-Chirurg. Trans., op. cit.

§ On the Structures of the Serous Membranes; Anatomical and Pathological Observations. Edinburgh, 1845.

|| On the Healing of Wounds in Articular Cartilage, &c. P. Redfern, M.D. 1851.

neration of the component cartilage cells; and the shredding and loss of tissue which obtains, is due to apparent absorption and destruction of the hyaline substance, which splits up and softens into a gelatinous and finely molecular material. These changes take place in the majority of all serious diseases of the knee-joint, although the exact nature of the cell transformation varies, and instead of presenting a granular appearance exhibits a fatty or fibrous consistence. Such variations are, however, dependent on the character of the morbid actions; for while in acute and chronic inflammatory destruction of the joint, the granular change predominates, that of a fatty nature results in such instances in which the articulation, although not positively or seriously diseased, has remained unused for a considerable period. When a gouty or rheumatic taint is plainly visible in influencing joint mischief, the articular cartilages undergo a decided fibrous degeneration. The same transformation of the cartilage-cell is apparent in the cartilages of elderly people, and in such conditions in which the synovial apparatus has been more or less chronically destroyed or removed, and the articulating ends of the bones have become susceptible of pressure. To see this fibrous degeneration it is only needful to examine a portion of cartilage on which mechanical influences have acted.*

These various changes, constituting so-called ulceration of cartilage, may be either primary or secondary affections. As a primary result, they are supposed by Sir B. Brodie and other surgeons to constitute the earliest symptoms of a large proportion of scrofulous diseases of the joints, but especially of the hip. I have no doubt myself that a very early lesion of the cartilaginous structure constitutes the original mischief in many instances of serious joint disturbance. I have had opportunities of strengthening this impression very lately; but yet I cannot avoid stating that, in several instances in which the cartilage has been the only structure apparently involved, a careful examination of component joint tissues has frequently enabled me to observe co-, if not pre-existing mischief in other parts. I mention this fact because in an instance in which the knee-joint was excised for so-called "primary ulceration of the cartilages," I detected indisputable evidences of serious disease in the bony lamellæ, and adjacent cancellous structure.

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* Med.-Chirurg. Trans. See a very interesting paper by Thomas Bryant, F.R.C.S.

Although, as just stated, disorganization of cartilages as a primary affection is by no means an unfrequent cause of serious joint mischief, still it is more usual to find the cartilages undergoing destruction, in consequence of well-established disease in neighbouring structures. In inflammatory conditions of the synovial membrane, and in the pulpy degenerations of the same tissue, ulceration of the cartilages ensues. The rate and amount of destruction greatly depend on the urgency of the inflammatory lesion, the constitution of the patient, and the condition of parts in immediate contact with the cartilage. Purulent fluid, soaking the cartilage, will often cause it to soften with rapidity, and quit its junction with the bone.

I have known, in more than one instance, acute inflammation of the synovial membrane lead to denudation and softening of the cartilage, in less than three days; and, in one instance in which acute suppuration of the knee-joint was very speedily induced and terminated fatally, the articular cartilages had entirely disappeared, except at such points at which they had remained in contact with each other. Though these observations serve to show that the cartilages may become rapidly altered when exposed to certain morbid influences, still it is much more common for them to resist any very decided diseased action till neighbouring structures have become considerably implicated. Months and years frequently pass away ere a knee-joint involved in chronic disease of the synovial membrane, exhibits any distinctive evidence of the cartilages undergoing disorganization. It is not, as a rule, till additional inflammation, or even suppuration, has been lighted up, that these structures show evidence of well-marked destruction. A very frequent cause, at least so far as my own observations extend, is a secondary or consequential disease of the articular cartilages, arising from previous implication of the sub-cartilaginous lamella and adjacent cancellous structure. This form of destruction is well illustrated by a drawing taken from a preparation in the Museum of St. Thomas's Hospital.

It will be noticed that the majority of the cartilage covering the condyles of the femur is intact, and, to all appearance, healthy, except at one spot, where it is entirely destroyed by reason of disease situated in the sub-bony lamella. When the cartilage is involved in this way, it is necessarily first affected at that portion which lies in contact with the bony lamella; and thus it is that pain, owing to the bony plate being included, is a formidable and urgent symptom of its destruction. For a long time ere the true structure of cartilage was known, it was supposed that the pain and starting of the limb followed the destruction of this tissue, and that both were owing to the morbid processes which ensued in the substance itself. Into this error Sir B. Brodie fell, in his early researches, but now it is universally admitted that pain is entirely dependent on the exposure and mechanical irritation of the bony lamella, at such parts at which it is uncovered by its cartilage.

The implication of articular cartilage arising from primary lesion of the ends of the articulating bones forming the knee-joint, will meet with consideration when treating of the nature and pathology of such morbid changes which involve the bony structure.

For a more detailed account of the pathological changes which ensue in the articular cartilages, as a result of diseased action, the works of the following authors may be consulted:—William Hunter, M.D., "Of the Structure and Disease of Articulating Cartilages" (Phil. Trans., vol. lxii., 1743); Henle, "Ueber die ausbreckung des Epithelium in Menschlichen Körper" (Müller's Archiv, 1838); with those of other well-known German and French authors.

VI. DISEASED CONDITIONS OF THE ARTICULAR EXTREMITIES OF THE BONES FORMING THE KNEE-JOINT.

It has been observed that morbid processes by no means unfrequently commence in the cancellous structure of the ends of the long bones, and lead to extensive mischief, by causing perforation of the cartilages, and destruction of the bordering articulation. In the majority of instances, disease of the joint, dependent on inflammatory changes, is rendered more or less complex and specific by reason of constitutional taints, general systematic derangement, and local influences. The various kinds of diseased action which so destroy the articulation, may be thus considered.

Firstly.—Simple inflammatory changes taking place in the open structure of the ends of the femur and tibia, may be either acute or chronic.

Acute inflammation of the spongy structure of the heads of the two long bones, may be of two forms—*diffuse* and *circumscribed*—and occur in individuals of any age, as the result of injury, or severe cold, &c. From whatsoever cause it follows, —provided no specific diathesis exist—the phenomena exhibited are analogous. A portion of, or even the entire spongy tissue may be involved in inflammatory changes. In the early stages, if the action be rapid and acute, increased vascularity, heat, pain and throbbing, will be more or less prominently marked symptoms. Should the mischief advance, the meshes of the bone become filled with serum, depending in character on the height of the inflammatory process. At this stage the covering integuments sympathise, and tenderness, with stiffness of the joint, adds to the general discomfort. Should the inflammatory mischief advance beyond the mere effusion of serum, it is probable that the delicate cells, becoming the seat of progressive inflammation, may die, and a true necrosis of a greater or less portion of the cellular network ensue. This death of a portion of cancellated bone may arise as the immediate consequence of direct injurious influences, such as sudden injury, attacks of extreme cold, &c., or as the sequel of more or less violent inflammation. The nature of the disturbance varies in accordance with the cause. When the bone is suddenly affected, and the portion involved is limited, the transition from life to death is rapid, and may take place without the occurrence of the usual symptoms of progressive decay. Under these circumstances, supposing that the osseous structure be not situated in very close proximity to the sub-cartilaginous lamella, little or no important disturbance may ensue. I have several times known rapid circumscribed necrosis, occurring in the expanded end of the long bones and resulting from violence, run its course without occasioning any very decided annoyance, either local or general. It is not necessary that abscess should always follow, although in diffuse osteitis the formation of pus is a very usual accompaniment, or rather sequel, of acute inflammation. A local abscess oftentimes, however, does form, and if not limited may lead to certain destruction of adjacent structures, and probably also of the joint. When a circumscribed portion of bone is acutely inflamed, it may after its death remain necrotic, and separated from healthy structure by means of a vascular membrane.

As an inert substance, it may be retained for a considerable period; but more frequently efforts are made to cast off the effete portion of osseous material. The processes securing this end may be exerted in one of two directions—either the walls of the bony shaft may be perforated, the periosteum detached, and thus the dead portion extended into surrounding parts, with or without the aid of the surgeon; or the destructive and eliminative process may take place in the direction of the joint, and perforation of the cartilages enable the foreign material to be discharged into the articulation. In either case, abscesses form in the soft parts, and by means of sinuses admit the exit of all disintegrated and pent-up morbid material. With the occurrence of acute inflammation of the ends of the bones, which may ensue at any period of life, more or less prominent symptoms of constitutional disturbance may present. Irritative and hectic fever, associated with intense local pain, may lead to serious implication of the neighbouring articulation, and demand a resort to a capital operation for the removal of the mischief. The operations most appropriate are amputation and excision of the joint, but their comparative advantages will be hereafter canvassed.

Chronic inflammatory changes in the ends of the long bones may be either diffuse or limited. When the inflammatory process, no matter how generated, spreads over an extensive surface of the cancellous structure, the changes which take place are in accordance with the urgency of the inflammation. Should the progress of the mischief be slow, nothing further may result than an increased vascularity of the osseous meshes, which may either terminate in resolution, or advance to suppuration and death, of the affected portion of bone. Provided resolution obtain, but slight, if any, damage will, in general, be done; but if the inflammation advance, it will, in all probability, seriously incapacitate, or lead to the destruction of the joint and adjacent structures. When the inflammation is limited and circumscribed, it may run its course either favourably or unfavourably.

This form of inflammatory action is of very common occurrence, and is liable to happen at any age and in all subjects; but I am more inclined to look upon it as most commonly affecting the bones of adults. When one or more portions of the cancellous structure of the bone are included in an inflammatory attack, and the mischief progresses so as to be incapable of resolution, then one of two forms of destruction takes place. Either one or a series of small abscesses occupies those parts which were originally attacked with inflammation, causing disintegration; or the bone involved dies rapidly, apparently without the formation of pus, and remains (as already observed, when speaking of the effects of acute inflammation in cancellous bone) either as a foreign body hemmed in by a false vascular membrane, or else gradually undergoes the process of decay.

These two forms of disease are illustrated in the well-executed drawings of preparations of bony parts, removed in the operation of excision of the knee-joint, Nos. 1, 2, and 3, *Plates* 3 and 4, and the cases to which they refer, being of great interest, will be presently recorded.

When abscesses, such as described, result, it is highly probable that their elimination into the neighbouring joint may take place by destruction of the bony lamella and articular cartilage. To this form of disease, I believe, can be traced the destruction of many joints; and judging from personal observation, I imagine that the *extra*-origin of joint affections is not sufficiently attended to. Sometimes, escape of the purulent fluid takes place by perforation of the bony shaft, leaving the articulation uninjured. Should the evacuation of the purulent cavities be followed by repair, the nature of the reparation may vary. Perhaps, the cavities will become occluded by reason of their walls coalescing, or the pyogenic membrane which lines them may form the nucleus from which a white, fibrous, and perhaps, eventually, a bony healing may spring.

When the portion of bone included in the inflammatory process dies, without the apparent production of pus, at least to any considerable amount, it may remain for almost an indefinite period separated from adjacent healthy structure by a vascular tissue, till eventually it leads to implication of the articulation. This limited form of necrosis from chronic inflammation, and the repair of the cavities in which the dead portion or portions may be imbedded, is most beautifully shown in *Plate* 4, representing the portions of a knee-joint removed by excision on account of long-standing disorganization. The alteration in density and compactness of the cancellous structure, when chronic inflammation attacks a portion or the whole of its extent, is a feature which very materially, I believe, influences the applicability of excision, as a means of treating the advanced forms of chronic disease of the knee-joint; but on this point I shall dwell more at length in a future part of this essay.

As only a sketch of the various diseases which involve the knee-joint and occasionally demand removal is intended, I refrain from entering more fully into the pathology of this interesting affection. I cannot, however, avoid remarking, that when once the cavity of the articulation is opened by perforation through the cartilages, the same form of destruction ensues as in the diseases already described; and it is only by a correct understanding of, and an extended acquaintance with, the various phases of the disease, that the surgeon can advisedly resort to the wisest, most humane, and most conservative treatment.

ON TUBERCULOUS DISEASE OF THE ARTICULATING ENDS OF THE TIBIA AND FEMUR.

Morbid deposition, consisting of true tuberculous material in the cancellous structure of the expanded ends of bone, is, so far as my own experience goes, an affection of common occurrence, although some surgeons are disinclined to admit its frequency, and to look upon such cases as examples of mistaken identity. A recent author writes:—"I cannot for one moment doubt that the majority of the cases which are described by surgeons as strumous, or scrofulous disease of a joint, and of the articular extremities of the bones, depend upon a chronic inflammation of the bone." . . . . "And that it is quite exceptional to find in any bone that yellow cheesy material which pathologists so well know as strumous deposit, although such must be regarded as a pathological curiosity."*

This tuberculous condition may be found destroying the cancelli of the spongy ends of the tibia and femur in two distinct ways—either as a circumscribed or partial invasion; or as a more general infiltration of the greater part, or entire extent of the osseous surface. Furthermore, these conditions may ensue as acute or chronic affections, accompanied with complete or partial destruction, not only of the invaded bone structure, but also of the articulation—the chief portion of which is formed by the expanded bones in which the disease may have settled.

Firstly.—With regard to the diffuse variety of the disease, I think that the character of this form of tuberculous infiltration may, in general, be regarded as one of a sub-acute or chronic nature, rather than as one possessing acute conditions. It is not unusual to find this affection involving the bones of children of a decidedly scrofulous temperament; and on all occasions it is to be dreaded, when any disturbance to the functions of the parts forming the knee-joint is complained of.

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* Bryant, op. cit.

It commences by a general, low, inflammatory state of the open network of the spongy tissue—the part affected exhibiting a congested and livid condition, dependent upon the contained medulla being mixed with blood. The temperature of the involved parts is increased; and should the disease be confined to the expanded portion of one bone, a tolerably correct impression as to the seat of mischief may oftentimes be obtained. If this inflammatory condition be not overcome by local treatment, it is probable that its advance will still more materially damage the bone. Exudation into the basement structure of the lining membrane of the cancelli ensues, and the cancelli themselves become filled with a fatty, oily, lardaceous, gelatinous material, which is, *in every respect*, analogous to pulmonary tubercle. This exudation may become deposited in the entire cancellous extremities of the tibia and femur, and exhibit a susceptibility to certain changes, as shrivelling, withering, drying, &c.; which may so far alter the original deposition as to permit of its remaining a comparatively harmless substance, completely blocking up the cancelli, but not leading to further implication. Unfortunately, however, such is not by any means the usual and wished-for termination of these cases. When congestion has given way to distinct infiltration of the morbid material, the bone undergoes an organic change—the earthy proportions become considerably altered, and sometimes allow the expansion of its thinned and reduced extremity; while the compact structure, which was sufficient to maintain the form and proportions of the osseous cylinder ere the disease commenced, now degenerates into a mere shell. To such a thinness is this structure reduced that the inflammatory action, at first only involving the open bony network, is propagated to the periosteal covering, which thickens and shows a tendency to quit its osseous connections. One step further in the advance of the disease leads to still greater destruction. Liquefaction of the morbid material takes place, and the weakened and expanded cancelli break down: in a word, ulceration has commenced, and is rapidly leading to perforation of the thinned walls which confine the mischief. Advance is made either laterally or towards the joint cavity, or ensues in both directions. If the destructive process involves the compact sides of the bone, then the already attenuated structure quickly gives way: ulcerated openings soon appear, which admit the extrusion of the liquefied material and debris of bone. The periosteum becomes stripped from its connections: abscess with conjoined thickening of adjacent parts, not immediately involved, soon leads to ulceration of the integuments, and formation of sinuses along the course of the fasciæ, muscles, and tendons of the part. In this way acute and chronic mischief may so involve the bones, that removal of the implicated portions may become imperative. (*Plates* Nos. 1 and 1A.)

But it very frequently happens, after various destructive changes have taken place in one or both ends of the cancellous parts of the tibia and femur, that the integrity of the joint which they tend to form is seriously impaired by reason of the articular cartilages being broken through, and permitting the escape of the tuberculous material. In this way the synovial membrane becomes implicated, the joint cavity distended; and, irritated by the presence of foreign material, admits the formation of abscess, and consequent distension of the ligaments, which allow displacement and luxation of the head of the tibia and patella. With the formation of abscess in the interior of the joint, effusion, thickening, and cellular abscess take place external to the capsule; so that eventually the foreign matter finds a free exit, provided the fistulous communications continue. In this way tuberculous, or what is commonly called scrofulous, disease of the joint proceeds, till not only the bones forming the joint and the integuments covering it are involved, but also the articulation itself. With all this mischief there is frequently very considerable disturbance of the general health, and probably other local manifestations of severe scrofulous disease; so that the surgeon is often compelled to resort to some definite means for the removal of the joint disease. What those means are will be duly considered hereafter. But, fortunately, it very often happens that reparation occurs even after very great destruction has taken place, and there results a limb which, if not useful by reason of the deformity which has ensued, can occasionally be made of value as a means of progression, by the adoption of such proceedings as mechanical straightening, with or without division of the surrounding tendons, or excision of those parts which occasion the flexed and dislocated position of the lower limb, in proportion as the nature of the reparative material is bony, or of a more yielding structure.

Secondly—Circumscribed tuberculous disease of the articulating ends of the femur and tibia forming the knee-joint.

Studied correctly, this form of tuberculous affection of the ends of the bones possesses great interest to the practical surgeon, for it is on a right understanding of its pathology that conservative measures may often be adopted to preserve a useful extremity, even when the articulation is hopelessly destroyed. In this limited and circumscribed form of disease, the earliest change which takes place in the portions of bone, the seats of the mischief, is an inflammatory congestion, evidenced by a certain amount of heat and tenderness, increased by manipulation over the affected region. Should this condition progress, the next stage is that of exudation of the tuberculous matter which stuffs the cancelli included in the inflammatory disturbance, and more or less completely destroys the osseous meshes. Limited by the inflammatory changes which have occurred in the adjacent healthy bone, the exudation may undergo various metamorphoses. Should the involved cancellous structure be blocked up to the exclusion of all circulation, it is impossible, as Dr. Black has well observed,* for ulceration and suppuration to ensue, for where there is no circulation there can be no pus formed. It is then at the circumference of tuberculous exudations that destructive changes commence—at such parts where they border on healthy but inflamed tissue. Hence it is not unusual to find deposits of tubercle in the centres of cancellous bones, remaining unchanged for considerable periods of time, till subsequent neighbouring mischief enables the process of germination and eventual purulent destruction to take place. Scattered tuberculous deposits of a moist, or dry, yellowish, cheesy, pasty, and chalky consistence, are frequently found imbedded in the open tissue of the tibia and femur, causing destruction of the bone substance, and subsequently of the joint. When such is the case, I have found that the subjects are generally young children, in whom the scrofulous habitus is well marked; although adults of the same constitution are by no means exempt. The process of destruction is analogous, although modified in intensity, to that which obtains in more diffuse infiltration.

The condition in which circumscribed tuberculous masses are frequently found imbedded in the ends of the bones forming the knee-joint, is well seen in *Plates* Nos. 2 and 2A, which illustrate the state of the osseous portions removed by myself, in an operation of excision of the articulation, for limited and circumscribed tuberculosis of the ends of the bones, which led to complete destruction of the articulation.

The changes in the surrounding healthy bone which ensue on the extrusion or degeneration of the tuberculous exudation, are such as render the excision of the parts an applicable and judicious operation; but on this point I shall have more to say and illustrate in a future part of the essay. The nature of the reparative processes cannot, therefore, fail in interest to the practical surgeon. The most usual repair which takes place is a gradual narrowing and consolidation of the vacated spaces—a coalescing or fusing of the opposite walls and surfaces. In this way obliteration so perfectly ensues that all trace of a previous cavity may be lost. Again, a fibrous tissue, more or less tough and firm, may become the permanent mode of reparation, although it is not uncommon to find this structure the matrix of new bone formation. Or it may happen that after the evacuation of all disease, and circumstances are favourable, new bone may at once be formed, and the whole of the once open structure become converted into one of a firm compact character. From this form of disease, anchylosis, either fibrous or osseous, but more commonly the former, may result; and a practical acquaintance with the mechanical changes which ensue, will be found of immense advantage in considering the applicability and usefulness of excision of the vitiated joint over amputation of the thigh.

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* Pathology of Tuberculous Bone. By Dr. Black. 1859.

The more minute pathology of this highly interesting affection I have purposely omitted, because it bears no very special relation to excision of the knee-joint, beyond what I have mentioned.

ON TUMOURS INVOLVING THE EXPANDED EXTREMITIES OF THE TIBIA AND FEMUR, AND IMPLICATING THE KNEE-JOINT.

The lower end of the femur, and head of the tibia, are exceedingly prone to assume various morbid conditions, other than described in preceding pages. These abnormal states are chiefly growths, or tumours which have a more or less malignant character, and consist partly of bone, and partly of newly developed and degenerative, soft, and vascular structures.

They may be briefly noticed under the following heads of Exostosis, Osteo-cystoma, Osteo-sarcoma, Osteo-cephaloma, Myeloid, Osteo-melanosis, and various vascular and pulsating tumours which cannot well be named, owing to their variety of conformation. When the more malignant of these growths affect either the end of the thigh bone, or the head of the tibia, their nature is such that removal by excision of the joint is, in general, insufficient, even to inspire the least hope of amelioration, much less of cure; and, therefore, it is scarcely necessary to review them more minutely, as the amputating knife is the only means by which any definite riddance can be hoped for. Affections of a more benign character, such as exostosis and fibroid growths demanding removal, may be so situated, when involving the knee-joint, as to enable the articular surfaces to be taken away without the sacrifice of the lower extremity. I am not, however, aware of any instance in which excision of the joint has been resorted to for these conditions; while amputation is deemed by all surgeons the appropriate treatment when less formidable operations are insufficient.

ON INFLAMMATORY CONDITIONS ARISING EXTERNAL TO THE KNEE-JOINT.

It occasionally happens that disease involving the knee-joint follows inflammatory disturbance arising external to the capsule, and seated in immediate relation to the articulation. When following as the consequence of damage to parts in near proximity to the joint, the mischief usually consists in an inflammatory condition of the surrounding cellular tissue, and of other parts situated close upon the articulation. When the mischief commences in the cellular tissue, it may arise in consequence of injury, or cold, or as the result of some specific inflammatory lesion, as erysipelas, &c., and be either acute, or chronic in character.

When proceeding from injury, in plethoric individuals, it may prove refractory to treatment, and be propagated to the joint, when various destructive changes, such as have been described, ensue. Should suppuration follow, it may be limited to the tissues external to the articulation; and the purulent fluid being discharged, the parts regain their normal condition, and the joint, although stiffened, remains intact. The diagnosis of inflammatory mischief of the cellular tissue external to the knee-joint, and its requisite treatment, have been well illustrated by Mr. South.*

Should the knee-joint become seriously involved by propagation of the inflammatory process arising in the cellular tissue, and demand operative interference, it will hereafter be discussed how far destruction of the surrounding joint-structures invalidates the adoption of excision.

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* Edition of Chelius, vol. i., p. 210.

When the knee articulation is disorganized by reason of specific inflammation,—such as erysipelas, &c., originating in the soft parts contiguous to it, or in those more remote, and leads to extensive destruction,—the appropriativeness of excision is highly dubious; although judicious treatment, and forethought in anticipation of future interference, may sometimes enable such a conservative proceeding to be adopted, in lieu of amputation.

In very delicate and scrofulous children, it is not unfrequent, as Mr. Bryant has lately well observed,* for abscess to form in the cellular parts immediately adjacent to the knee, and give some degree of trouble in diagnosis and cure. I have seen many such cases in strumous and ill-nourished children, dependent and independent of joint disease; but with care and due appreciation, the affection can be satisfactorily distinguished, although the integrity of the joint may become so much involved, as to lead to the question of removal. I see no reason why excision, in the majority of instances, should not be adopted in preference to amputation; and I shall quote some cases to prove that considerable implication of soft parts, offers sometimes but little impediment to the satisfactory performance of the former operation.

The fibrous structures in close relationship to the knee-joint may become affected in such a way as to lead to its disorganization; but it is seldom that such disturbance, which is in general rheumatic or gouty in character (at least, so I believe), leads to very serious mischief of the articulation; although anchylosis, more or less firm, may disfigure and impair its functions, and demand rectitude by such an operation as excision.

The Bursæ about the knee are liable to inflammation of an acute and chronic character, which may spread to the joint, and so far destroy its integrity as to necessitate formidable surgical measures. Such a termination is not, however, frequent, but it does occur, and it behoves the practitioner to consider whether excision can be substituted for amputation of the limb, when removal of all disease is imperative.*

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* Bryant, op. cit.

ACCIDENTS AND INJURIES TO THE KNEE-JOINT.

The knee is liable to sprains and contusions which may lead to serious diseases of the articulation in one or other of the forms that have been considered, and need the direct interference of the surgeon. From various cases to be hereafter mentioned, it will be seen with what success the operation of excision was attended, when resorted to on account of destruction of the joint, arising from one or other of the above-named accidents.

Dislocation of the knee, originating from violence and unattended with fracture, is not likely to cause such disturbance as to demand the use of the knife; but when associated with fracture, especially if compound, it is not unusual for the surgeon to resort to operative measures either immediately after the accident which has occasioned the mischief, or at such period when undue inflammation ending in suppuration and ulceration shall have seriously implicated the joint.

Compound Dislocations of the knee-joint are most serious accidents, although, comparatively, of rare occurrence; but, as Sir Astley Cooper has well observed, there are scarcely any accidents to which the body is liable which, generally speaking, more imperiously demand amputation.† Chelius is also explicit on the point, and says: "If the joint-ends of bones be thrust through the skin, there may be such destruction that immediate amputation is requisite. Single cases in which the preservation of the limb is possible, cannot refute these principles."‡

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* A case occurred at King's College Hospital curiously illustrating this form of disease. A seton was passed through the enlarged bursa situated under the tendon of the quadriceps: violent inflammation ensued, destruction of the joint took place, and on examination a natural communication between the bursa and the synovial capsule of the joint was found to exist.—H. S.

† Work on Fractures and Dislocations, p. 217.

‡ Chelius. South's Ed., vol. i., p. 806.

So rare, however, are these accidents, that Mr. R. W. Smith, in his excellent and practical treatise on "Fractures and Dislocations," does not mention having met with a single instance.

Fracture of the lower end of the femur, through one or both condyles, and involving the joint, is by no means so rare, but the local and constitutional disturbances which follow are more modified, and devoid of such extreme danger. Nowadays the surgeon, even if the mischief be compound, provided the large vessels in the popliteal space be not included, deems it in accordance with improved and conservative doctrines, to save the shattered part, and, therefore, primary amputation is the exceptional practice in such cases. Inflammatory disturbance advancing to suppuration and ulceration, may, however, necessitate active measures, and the surgeon may then be obliged to consider the propriety of resorting either to amputation or excision, for the removal of the affected joint. When the operation of excision has been considered, as applied to the treatment of an injured knee, which has *not* been previously involved in disease, it will be more readily perceived how far it is applicable.

Forcible separation of the lower portion of the Epiphysis through the line of junction. It has been seen that up to a certain period of life, the femur in its development consists of three parts, and the permanent junction of the various portions is not complete till manhood has commenced. A knowledge of the connection of the condyles of the femur with the shaft, will at once explain how, under certain circumstances, the lowest portion of the thigh-bone may be forcibly torn away from its shaft in the line of epiphyseal union.

This accident, however, appears either to have been occasionally overlooked, or to have received but slight practical notice at the hands of hospital surgeons; for, so far as I am aware, no mention of it is to be found in any of the standard works on the subject of Fractures and Dislocations.* Very lately, Mr. Canton has had two such cases under his care; and as each was treated by excision of the disconnected portions of the joint, I shall defer further observations on the subject till that proceeding, as applied to injuries of the joint, is discussed at greater length.

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* I have since obtained references to a few cases which are found described at that portion of the essay which treats of Mr. Canton's cases.

WOUNDS OF THE KNEE-JOINT CAUSING DISORGANIZATION AND DESTRUCTION.

In civil practice punctured and incised wounds of the knee-joint not unfrequently call for the earnest attention of the surgeon, for such lesions of the articulation are always more or less attended with danger, not only to its functions, but to life itself. Amputation of the limb above the seat of injury, or removal of the involved structures without the sacrifice of the lower limb, may therefore be rendered imperative either immediately after the accident, by reason of the extensive nature of the wound, or at a more distant period, when inflammatory disturbances have so far progressed that other treatment is of no avail. With what hope of success the more conservative operation of excision may be adopted in preference to that of amputation, will be presently more particularly dwelt upon.

But it may be mentioned that generally capital operations are not nearly so favourable in their results when adopted for wounds and injuries occurring to a healthy joint, as they are when performed for the relief of disease of long standing, or for accidents which happen to articulations previously more or less impaired.

In military practice the knee-joint, or hard structures immediately bordering on it, are very commonly so injured by musket balls and splinters as to call for surgical interference, either at the time of the occurrence or at a more distant period. With regard to the course to be followed on such occasions, the late Mr. Guthrie is very explicit:—"Wounds of the knee-joint," writes this distinguished surgeon, "from musket balls, with fractures of the bones composing it, require immediate amputation; for although a limb may be sometimes saved, it cannot be called a recovery, or a successful result, where the limb is useless, and is a constant source of irritation and distress, after several months of acute suffering have been endured, to obtain even this partial relief from impending death."* How far this precept accords with the military surgery practised in later wars, as those in Schleswig-Holstein, in the Crimea, and in India, will be duly considered in accordance with the views of Stromeyer, Esmarch, Macleod, Matthew, &c.

ON DEFORMITIES ARISING FROM DISEASE AND DESTRUCTION OF THE KNEE-JOINT IN WHICH SURGICAL INTERFERENCE IS DEMANDED, OR DESIRED, TO RECTIFY THE ABNORMAL POSITION AND CONDITION OF PARTS.

It has been previously stated that, with the occurrence of disease of the knee-joint, especially when of a chronic character, relaxation of the connecting ligaments and other tissues obtains, permitting more or less complete displacement of the extremities of the bones forming the articulation. When such deformities arise, the tibia is the principal bone which admits of displacement, the head being usually drawn somewhat backwards, and displaced either outwards or inwards, and the lateral direction which the axis of the bone takes being, in a great measure, dependent on the position assumed by the limb during the period the articular mischief is progressing.

The extent of deformity is sometimes astonishing and unusual. For instance, in the Museum of St. Thomas's Hospital, there is a preparation (No. 96 D) presented by the late Mr. Cline, exhibiting osseous anchylosis of the bones forming the knee-joint, in which the tibia is dislocated forwards at a right angle with the lower end of the femur.

It is much more frequent, however, for the head of the tibia to be drawn backwards by the action of the hamstring muscles, and sometimes to such an extent that the end of the femur projects forward.†

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* Commentaries on Surgery. By G. T. Guthrie, F.R.S. 1853.

† Here a drawing furnished by the Author has been omitted.—H. S.

This form of spontaneous dislocation of the head of the tibia from disease, is well illustrated in Preparations Nos. 973 and 974, Section G, Series xiii., belonging to the Museum of the College of Surgeons.

Such an amount of luxation is, however, not so commonly met with as partial displacements, where the head of the tibia is merely shifted or twisted on its axis, and the articular extremities of both bones remain in contact.

When the structures of the joint are disorganized and removed by destructive processes, provided Nature be successful in obtaining reparation, the character of the repair is modified in accordance with the amount and kind of destruction which has taken place in the articulation, the constitution and age of the patient, and the method of treatment which may have been adopted. This kind of repair is termed *anchylosis*, and may be either completely osseous or fibrous, or of a mixed character.

Osseous anchylosis is apt to follow disease of the knee-joint, when the articular cartilages have been removed, so as to allow the surfaces of the tibia and femur to come in direct contact. The character and strength of the junction is dependent on circumstances. Sometimes the opposing surfaces are found joined together, as it were, by a simple process of adhesion, the amount of new bone being very slight; at other times one or more portions of fresh cancellous bone issue from one or both extremities, and may be traced coalescing and leaving interspaces forming bridges, which are frequently sufficiently strong to allow active use of the lower limb. Or it may be, that the new osseous material which is formed partakes more of the character of indurated or compact bone, and exists either between the entire surfaces, or only at various parts. The kind of bony anchylosis, however, which results as a reparative process after diseases of the knee-joint, may be much modified. Supposing that the diseased actions which deprived the joint of its functions, and destroyed its component structures, were primarily seated in the ends of the bones—strumous or tuberculous infiltration, for instance—it will generally be found that the bony material, if any be formed, is scanty, and devoid of those essentials which are needed to insure a firm osseous junction.

Preparations Nos. 3356, 3357, 3358, and 3359, in the Museum of the College, exhibit the various kinds of osseous anchylosis which follow disease and destruction of the joint, and also point to the necessity of endeavouring to direct such favourable process in a way that shall be most beneficial to the sufferer. It will be readily seen that if due attention be not paid to the position of the lower limb during such reparation, the chief designs of Nature are, in a manner, frustrated by reason of the deformity which results. To enable a patient to make use of a limb thus distorted, the hand of the surgeon is frequently required to undo the good that has been effected, but rendered abortive by want of surgical tact.

Examples of distorted bony anchylosis, in which excision has been employed to obtain a useful limb, will be recorded in a subsequent part of this essay, and also instances in which amputation was performed for the purpose of ridding the body of an encumbrance.

Fibrous or Fibro-cellular Anchylosis, uniting the femur and tibia, results from destruction of one or more of the structures forming the joint, and may obtain in the young subject, and in those individuals the composition of whose bones does not contain the usual amount of earthy material, and where degenerative processes—such as those of fat, tubercle, etc.—have led to impairment of the normal structure. In such instances the bond of union will be fibroid in character, forming connecting bands or bridges, of greater or less strength. Without absolute, or even partial removal of the cartilages, but simply from degenerative action, the same kind of bands or bridges may hold the ends of the two bones together more or less strongly, as is exemplified in Preparations 896, 897, 898, Section A, Sub-series ii., in the College Museum.

Very frequently, especially in highly scrofulous children, the only bond of union, even after destruction of the cartilages and baring of the bones have ensued, consists of such bands stretching between the circumferences of the bones taking their sole origin from the tissues external to the periosteum. The position of such fibrous anchylosing structures may, however, be further modified.

The thickened and indurated exudation which fills up the cellular tissue of the popliteal space, and increases so materially the size of a diseased knee-joint, is oftentimes combined with the tonic contractions of the hamstring muscles, the only band of union which maintains the surfaces of the destroyed joint in position.

MIXED ANCHYLOSIS AND FALSE JOINT.

Although osseous and fibrous anchylosis may arise independently of each other, still it frequently happens that the two coexist, and form, if not a permanent, at least a temporary mode of union. I believe that the reparative process which takes place in a fair share of cases of diseased knee-joint, is primarily of a fibroid and yielding nature, and that osseous formation is a subsequent event; or, in other words, that the yielding and fibrous tissue acts as the matrix in which bone is eventually formed. I am induced to this belief by the opportunities I have had of examining partially destroyed joints after excision and amputation; and the fact is one of great interest, when it is recollected that in many cases after the former operation, the connecting medium between the two joint-bones is oftentimes yielding at first, though eventually osseous.

But there is another form of anchylosis, or what may be more definitely described as *false joint*, which occurs during the reparative efforts of Nature to restore the utility of a diseased knee articulation.

It not unfrequently happens that from the exposed surfaces of articular bones, where the cartilages have been removed by disease, new bone is formed, and the growth from each osseous shaft coalesces, although their immediate bond of contact is not of an osseous, but of a fibroid, or mock-cartilaginous character; in fact, a false joint, admitting a greater or less amount of motion.

DISORGANIZATION OF THE KNEE-JOINT FROM VARIOUS FORMS OF DISEASE.

In the foregoing pages it has been my aim briefly, but systematically, to describe the various diseased and injured conditions which may attack the knee-joint, and render it advisable, if not imperative, to have recourse to its removal, by reason of the impairment and destruction which results. Although these various morbid alterations have been referred to as constituting original and specific affections, still they are oftentimes found so blended in instances of advanced disease of the articulation, that it becomes impossible to determine which constituted the primary mischief, and what structure was first invaded. In this dilemma it is found advantageous to speak of various diseased conditions of the joint as, "disorganization of the articulation," "chronic and long standing disease of the joint," "acute destruction of all the tissues of the joint," &c. &c.; it being both impolitic and almost impossible to attempt to specify more precisely the true pathological changes which may be taking, or have taken place; although, from the symptoms exhibited, there is more or less indication of synovial, cartilaginous, and bony alterations and destructions.

Under the terms acute and chronic disorganization of the knee-joint, may, therefore, with the greatest advantage, be considered the majority of cases (excepting those of a malignant character) which demand direct surgical interference, although a more precise phraseology may often be used in reference to simple abnormal conditions of the articulation.

In endeavouring to analyse the comparative value and efficiency of the two operations—amputation and excision of the joint—for the treatment of both simple and more complicated forms of articular disease, in accordance with the requirements of the subject of this essay, I think it will be advisable to draw my observations and deductions from the source of facts systematically and faithfully recorded; and I am the more inclined to this arrangement because, if I may be permitted to remark, the statements I shall make with regard to all the cases of excision recorded in my tables have, with but few exceptions, been received direct from those surgeons who have performed the operations. Moreover, I have spared no pains to make this collection of facts and observations as perfect as possible, aided, as I have been, by the courtesy and kindness of many operative surgeons not only of this country, but of France and Germany; and to forward, as far as in my power lies, the best interests of this department of practical surgery.

I would moreover observe that, having several times performed this operation, and having seen it adopted on more than seventy occasions, and enjoyed the opportunities of frequently watching the after management and treatment of the cases, I have been enabled to accumulate many interesting and practical features and facts regarding it, which I now submit.

A SKETCH OF THE EARLY HISTORY OF EXCISION OF THE KNEE-JOINT, FROM THE YEAR 1762 TO 1830.

"Morbid affections of the knee-joint," writes the late Professor James Russell, of Edinburgh, "exhibit a greater variety of appearance than the morbid affections of any other joint of the body." The history of the surgery of the last two centuries attests the extreme ignorance that prevailed with regard to the recognition and treatment of diseased conditions of the joint. The general terms spina ventosa and white swelling, were deemed sufficiently accurate to denote the various morbid states into which the articulations are prone to degenerate. An incorrect appreciation of the nature and cause of disease naturally prevented the adoption of any decided improvement in surgical practice. When the mischief would not succumb to the remedial measures usually employed, amputation of the limb above the seat of lesion was the universally accepted operation. To such an extent was this doctrine advocated, that many sufferers from articular disease, unwilling to submit to such decisive measures, eagerly sought advice and assistance from those in no way empowered to give it. Hence quacks and empirics abounded and flourished. Instead of endeavouring to define a more satisfactory mode of treatment in morbid affections of the joints, the educated surgeon seems rather to have devoted his attention to the improvement of the various methods for removing the limb. At the close of the last century the subject of amputation received the very general attention of surgeons in this and other countries, and the encouraging success which resulted from its improved performance greatly tended to enforce its more general adoption; but an innovation was at length introduced. Some intelligent surgeons in England and France, regretting the frequent occurrence of amputation of the limb when the disease was exclusively confined to the joint, conceived a much more efficacious and humane plan of treatment,—viz., the removal of the implicated articulation, without compromising the remaining healthy structures of the leg and thigh.

The first recorded instance in which this highly conservative proceeding was practised was in the year 1762, when Mr. Filkin, of Northwich, instead of amputating through the thigh in a case of extensive derangement of the knee, excised or entirely removed all the implicated tissues immediately connected with the articulation. The operation once performed, encouraged others to labour in the same field. Vigoroux and David, shortly after this, removed the head of the humerus; and in the year 1769, Charles White performed the same operation. (Chelius.)

In the year 1781 Henry Park, of Liverpool, repeated the proceeding for removal of the knee-joint, and proclaimed it a valuable addition to operative surgery. Excision of the bones forming the elbow-joint was also followed, with considerable success, by the same enthusiastic surgeon. In France the elder Moreau, about the same period, and subsequently his son, removed the wrist and ankle joints, and also practised the operation upon the knee, and elbow articulations.

Mülder, Fricke, Textor, Jœyer, Roux, Crampton, Syme, and other surgeons in France, Germany, and England, then, in a manner, accepted these operations, and occasionally adopted them with more or less success.

Although indirect allusion is made in the writings of Hippocrates, Paulus Œgineta, Heister, &c., still there can be no doubt that the operation of excising the knee-joint was first performed by an English surgeon. The record of this first operation is contained in a letter written to Dr. Symmonds, by Henry Park, of Liverpool, dated November 5th, 1789, and published in the eleventh volume of the "London Medical Journal." Mr. Filkin, of Northwich, was the operator; and the patient, a man of scrofulous habit, who had suffered from a tumour on the knee for many years. Falling one day from his horse, and fracturing the patella of the affected knee, a considerable quantity of pus was poured out. The injury seems to have been of such a serious nature, that amputation was immediately proposed, but positively rejected by the patient. Mr. Filkin, from his son's statement, had frequently thought that excision of this joint might sometimes succeed, and having once performed it on the dead body, suggested it in this instance. Consent was immediately given, and on the 23rd of August, 1762, the operation was performed. "The ligaments were found in a very sloughy, suppurative state, with the cartilages greatly injured, and the heads of the bones much diseased, particularly the head of the tibia. The patella, with the end of the femur and a portion of the tibia, were removed; a good digestion came on; the limb was kept in a straight position; and on the 21st of November, 1762, he was got so well as to require no further attention." Twenty years after the patient was alive and well, and in the possession of a very useful limb.

It is, however, to Henry Park, a surgeon in the Liverpool Hospital, that is due the merit of having clearly and practically shown the feasibility and advantage of removing the knee-joint when diseased, by the operation of excision. In a letter to his distinguished teacher and friend, the late Percival Pott, this able surgeon first communicated the ideas he had formed as to the treatment of diseased knee-joints,—"by the total extirpation of the articulation, or the entire removal of the extremities of all the bones which form the joint, with the whole or as much as possible of the capsular ligament, thereby obtaining a cure by means of callus, or by uniting the femur and tibia into one bone without any moveable articulation." The result of this well-digested consideration was the performance of the operation upon a patient of the name of Hector McCagleen, on the 2nd July, 1781, with complete success. "The patient," writes Park, "was a strong, robust sailor, æt. thirty-three, and had suffered with scrofulous disease of the knee-joint for ten years. Suppuration and caries had quite destroyed the articulation. The slightest movement gave excruciating pain. The operation was accomplished without much difficulty: about two inches of the femur, with rather more than an inch of the tibia, together with the patella, were removed. There was little or no bleeding. The limb was placed in a straight splint, made of tin, and allowed to remain at rest. Some considerable shock followed, and for a day or two he was much depressed. On the tenth day spasms of the leg annoyed him. On the twentieth day sweating and vomiting placed him in a critical position, but an abscess bursting in the neighbourhood of the wound, and allowing the exit of some small portions of carious bone, he was considerably relieved. The formation of abscesses, however, complicated his recovery, but in two months he was out of bed, and the union between the bones was found so strong that he could by taking hold of the leg with one hand raise the limb, and turn it as he pleased without pain, though the callus was still flexible. Ultimately he got a strong, useful limb, free from pain or swelling, and went to sea."

In the year 1789 this enterprising surgeon repeated the operation, but it was "as unfortunate as the first was successful." The patient, Charles Harrison, æt. thirty, a wheelwright, apparently strong and robust, but of a scrofulous family, had been a sufferer from disease of the knee-joint for about three years. The operation of excision was performed on the 22nd of June, and the constitutional disturbance was less than on the previous occasion. The limb, however, got into a bad position by the end of July, and the patient became so depressed by incessant vomiting and purging, that on October 13th, nearly three months after the operation, "he sank in spite of all our efforts."*

In the year 1783 the elder Moreau presented to the Academy of France a memoir upon "The Treatment of Caries of Bone," wherein he stated that he deemed it not impossible, where every other method of cure had been tried in vain, "to attempt to save the limb by an operation somewhat like amputation." From this proposal, and one or two indirect allusions to the operation, as proposed by Park, the younger Moreau believes that he does not risk much in saying "that the discovery was from that moment made, and that my father waited only for an opportunity to carry the ideas he entertained into execution."†

Ten years rolled away ere the great surgeon of the Hôtel Dieu found a suitable instance in which to test his matured speculations, as to the value of excision of the knee-joint. At Châlons-sur-Marne, in the year 1792, Mr. Clausse, the son of an apothecary, had been afflicted "for more than a year with a swelling of considerable size in his knee." Amputation of the thigh was advised, but the patient falling under the care of Moreau, this intelligent surgeon thought that the disease could be efficiently removed by excision of the parts forming the articulation. In this opinion MM. Percy, Chamerlat, and Gremiliet coincided, and on the 17th of September the operation was performed. On the *third day* the limb was placed in a machine for the purpose of keeping it in proper position. "At the end of the *third* month the consolidation of the bones was such that I left the limb at liberty in bed; the patient moved it about at pleasure. In short, I flattered myself that I should be able to make him walk on crutches in a month or six weeks; but an event, with which my operation had nothing to do, deprived me of that satisfaction." The patient, unhappily, fell a victim to a prevailing epidemic, dysentery.

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* Cases of Excision of Carious Joints. By H. Park, Surgeon in the Liverpool Hospital, &c. With Observations by James Jeffrey, Prof. of Anatomy and Surgery in the College of Glasgow. 1806.

† Park's "Treatise of the Excision of Carious Joints" was translated into French by Professor Lassus in 1784.

"The unfortunate termination of the case," adds Moreau, "deprived me the pleasure of enjoying the fruits of my care, but I remained convinced of the utility of the operation, and persuaded of the propriety and necessity of performing it in similar cases. I looked on my patient as cured, for I had no relapse to dread."

The records of surgery, so far as I am aware, contain no allusion to a repetition of this proceeding in France, until the year 1811, when the younger Moreau,* on the 5th of April, assisted by MM. Champion and Joly, removed the knee-joint of a patient aged thirty-one years. The articulation had undergone very considerable destruction, the bones being involved in caries. The operation was performed without difficulty; and although considerable trouble was experienced in the treatment, owing to the constant spasm of the muscles of the limbs, the patient made a good recovery. On examining the leg two years subsequently, the tibia and femur were found to be firmly united, and the limb in every respect serviceable. Although this operation was but rarely performed, still it is evident that hospital surgeons in the various cities of Europe were not unacquainted with it.

Mülder, of Groningen, in the year 1809, removed the knee-joint of a middle-aged pregnant female, for disease of long standing. The patient appears to have progressed well till the ninth day, when she was attacked with fever. Two months afterwards, when in a debilitated state of health, she gave birth to twins, and after the lapse of four months fell a victim to tetanus. Although the operation in this instance was unfortunately attended with an unsatisfactory issue, still reparation to some extent had taken place.

M. Fricke, of Hamburg, resorted to the operation on four occasions, but only one of his cases recovered. I have been most anxious to obtain particulars of the operations, but have failed to elicit any information of value. M. Velpeau, of Paris, who quotes these cases in his excellent work on Surgery, informs me that M. Fricke merely acquainted him with the bare fact of having performed the operations; and that, as far as he (M. Velpeau) is aware, full particulars have not been published.

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* Many writers have stated that the elder Moreau operated on three occasions. I have diligently searched French surgical works of the period, and fail to find mention of more than two operations.

In the year 1816 the late Professor Roux resorted to the operation, but unfortunately the case terminated fatally on the nineteenth day, from a combination of those accidents which often follow operations of magnitude. The local inflammation proceeding from the removal of the joint was not severe, nor was there any great amount of suppuration. Although the limb was with the greatest possible precaution confined in a suitable apparatus (?), still the leg and thigh could never be maintained in the same horizontal plane. The lower end of the femur remained thrust forwards, and the upper portion of the tibia drawn backwards.*

So unfortunate was the issue of this single case, of the operation in the hands of one of the best practical surgeons, not only in France but in Europe, that almost up to the period at which I am writing, succeeding French operators have vied with one another in condemning the proceeding. M. Velpeau informs me by letter, that while he much admires the energy of British surgeons, in their endeavours to establish the success of the operation, and although I have had the opportunity of placing before him some interesting and apparently convincing cases, still he prefers to adhere to the opinions he formed, from the result of Roux's case, which, I have no hesitation in saying, exhibited in treatment a want of skill and tact.

But to return.

In the year 1821 M. Textor, in the Julinsspital in Wurzburg, performed the operation, but unfortunately the patient sank. Shortly after this he resorted to the operation, but the termination of this case was in no degree fortunate; while the method of after-treatment appears to have been, in many ways, both unsurgical and inappropriate.*

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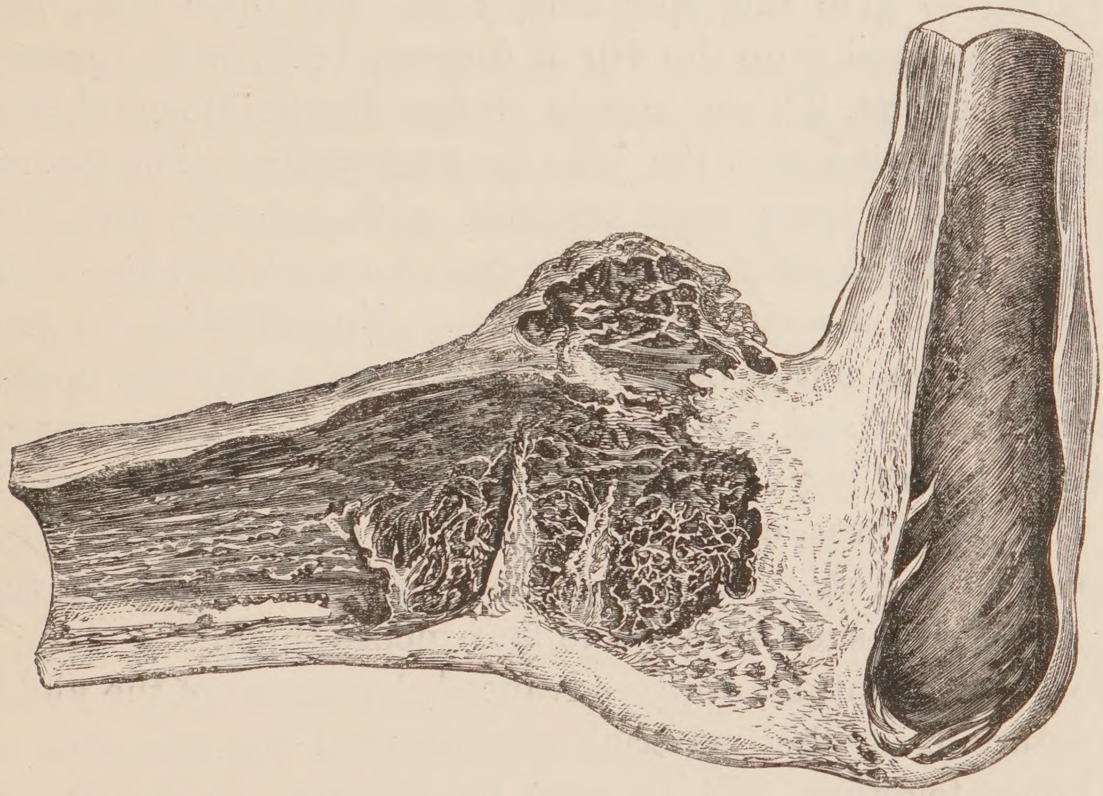
* Dictionnaire des Sciences Médicales. Par une Société des Médecins et des Chirurgiens. Paris, 1820, &c. Also, Roux's Private Correspondence. 1831.

After Park's unsuccessful case the operation fell into complete disuse, till Sir Philip Crampton, in the year 1823, resorted to it in preference to amputation through the thigh.

In the fourth volume of the Dublin Hospital Reports, this excellent surgeon reports two instances in which he had removed the knee-joint, and clearly states the objects which induced him to revive the operation, which, for so long a time, had remained unnoticed by British surgeons.

The first case recorded is that of Susan Conolly, æt. 23, a sufferer from strumous disease of the knee-joint for about twelve months. The operation was easy of execution (?). The ends of the bones presented the well-known appearance of diffuse strumous infiltrations of the cancellous structure. The end of the femur was exceedingly soft, the periosteum having peeled away from the bony parts for some distance. A slice of one inch and a quarter was removed from the femur, and a slice from the tibial head. When the parts



No. 1.

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* Von der Wiedererzeugung der Knocken nach Resection. 1842. Also derived from various German statistics.

had been adjusted, the limb was placed in one of Assilini's carrying splints. The operation was followed by little constitutional disturbance, and the wound united by first intention. Abscesses continued, however, to form; but after the lapse of a few months she was discharged from the hospital, although "no union had taken place between the bones." Six months made no difference regarding the state of the limb, as far as consolidation was concerned.

At the end of three years she fell a victim to disease of the lungs, and as Sir Philip pointedly remarks,—"The case proves that the operation might be done with safety, but that it was one to which the operation was not applicable."

Willing to give this operation a fair and open trial, this surgeon repeated it on the 4th of August, 1823, with success. Anne Lynch, æt. 22, an inmate of the Meath Hospital, had suffered from disease of the joint for four years. The operation appears to have been attended with extreme difficulty and pain (for chloroform was not then known), and the after-treatment was a series of bunglings. Nevertheless, in two months she was out of bed, and in six months after the operation the femur and tibia were consolidated. Three years afterwards, the leg and thigh were not in the least wasted, but the limb was considerably bowed outwards. At this period she was able "to stand, and walk the length of the day, wearing a shoe with a sole four inches thick."

To what extent deformity advanced, by reason of the yielding nature of the first material which united the cut ends of the bones together, will be seen by referring to the Woodcut, No. 1, on the preceding page, copied from the preparation of the bony structures forming the *new knee* (?) in the Museum of the Royal College of Surgeons.

In the year 1829, Professor Syme of Edinburgh, having met with success in the treatment of various diseased joints, by the operation of excision, removed the knee-joint. The patient was a little girl, eight years of age, and had suffered from disease of the articulation for three years. The operation was performed, little constitutional disturbance followed, but the greatest difficulty was experienced in keeping the bones in position. In three months the child could walk, and a short while after could run without a halt, and merely required the heel of the shoe to be two inches higher than the other. The anchylosis was fibrous, and admitted some degree of flexion and extension. Such is the encouraging report of this case at a comparatively early period after the operation; and although Mr. Syme was delighted at that time with his success, still, as will be presently stated, the indifferent progress which the limb made, as time passed by, induced him materially to alter his opinions.

The second case operated upon by Mr. Syme was a thin, delicate child. The knee-joint was much diseased. "Great difficulty," writes Mr. Syme, "was experienced, owing to the contracted state of the muscles in preventing dislocation of the femur, and the surface of this bone soon after the operation presented a dry, dead-like appearance; but the favourable termination of the former case, notwithstanding a similar and equally threatening aspect, prevented me from abandoning my sanguine expectations of success in this instance also. On the 6th of January, 1830, nine days after the operation, in order to prevent displacement of the bones, which all our efforts had been insufficient to effect completely, I cut away about two inches of the femur with the pliers, and observed with much concern that the bone was denuded beyond the farthest extent to which my finger would reach."* The patient began to sink soon afterwards, and died on the 8th of January.

I have been particular in recording the details of these four last cases, because a knowledge of them has very materially influenced the practice of British surgeons in regard to the treatment of diseases of the knee-joint, by direct operative measures.

The following table, embracing a few of the leading particulars relating to these various cases of excision of the knee-joint (although differing from others which have of late years appeared), will, I have but little doubt, be found as correct as a diligent search after facts can make it.

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* Treatise on the Excision of Joints. By James Syme, F.R.S.E. 1830.

TABLE I.

Containing a summary of seventeen cases of the operation of excision of the knee-joint, which occurred between the years 1761 and 1830.

No.	Operator.	Sex.	Age.	Date.	Results.
1.	Filkin ..	M.	23	1762	Cured.
2.	Park.. ..	M.	33	1781	Cured.
3.	Park.. ..	M.	30	1789	*Died.*
4.	Moreau, sen.	M.	..	1792	*Died.*
5.	Moreau, jun.	M.	31	1811	Cured.
6.	Mülder ..	F.	..	1809	*Died.*
7.	Fricke ..	..	..	..	Cured.
8.	Fricke ..	..	..	..	*Died.*
9.	Fricke ..	..	..	..	*Died.*
10.	Fricke ..	..	..	..	*Died.*
11.	Roux ..	M.	..	1816	*Died.*
12.	Textor ..	..	..	1821	*Died.*
13.	Textor ..	..	..	1822	*Died.*
14.	Crampton ..	F.	23	1823	Recovered from operation.
15.	Crampton ..	..	..	..	Cured.
16.	Syme ..	..	..	1829	Cured.
17.	Syme ..	..	..	1829	*Died.*
17.				6 Cured.	10 Died. 1 Recovered.

Thus it will be seen that in seventeen instances of the operation of excision of the knee-joint, six patients were cured, and had useful limbs given to them; ten patients died, at various periods after operation, and from different causes; while one recovered, but did not gain a limb in every way useful.

From the brief sketch which has been given of these seventeen instances of the operation, it will at once be seen, that the cases were not always judiciously selected; that some of the operations were not, apparently, very skilfully performed; while, in the entire number, the after mechanical treatment was, to say the least, quite inappropriate.

Although a critical inquiry into the histories of these various operations certainly does not impress the student with any very exalted idea as to the competency of all those surgeons who undertook the operations, still the recorded facts and experiences which have been handed down have proved of no inconsiderable value to those who of late years have resorted to similar proceedings.

I shall reserve all further observations on points of practical interest connected with these recorded operations, till a future part of this essay, and shall at once briefly record the particulars of all those cases which were performed between the years 1830 and 1850, inclusive.

SKETCH OF THE OPERATION OF EXCISION OF THE KNEE-JOINT FROM THE YEAR 1830 TO 1850, INCLUSIVE.

During these twenty years no single surgeon in this country, or in France, appears to have resorted to removal of the knee-joint by excision; and I fail to find, after a careful examination of continental records, more than seven instances, well authenticated, in which the example of Park was followed. All these cases occurred in the practice of three surgeons, and are as follow:—

On the 25th of January, 1830, M. Jœger excised the knee-joint of a mason, æt. 20. Disease had disorganized the articulation, and rendered recovery of a useful limb more than doubtful. On the tenth week the patient was up, and by the commencement of the fifteenth could walk.*

Between the years 1823 and 1842 Textor operated on three cases (but his success was by no means encouraging). One case was cured, and a tolerable limb was saved to the patient. The second case died; and the third, the most unfortunate perhaps, was subjected to amputation when excision had failed, and unhappily sank.†

Dr. F. Heusser, of Hombrechtikons (canton Zurich), removed the knee-joint once in the year 1848, and twice in 1849.‡

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* Theoretisch-praktisches Handbuch der Chirurgie. Von Dr. Joh. Nep. Rust. 1831. Vol. v.

Operatio Resectionis Conspectu Chronologico adumbrata. Dr. Michael Jœger. Erlangæ, 1832.

† Op. cit.

‡ Deuts. Klinik. Oct. 20, 1860. No. 10.

The case operated upon in 1848 was that of a man, æt. 20, a tailor, who had suffered from disease of the knee-joint for five years. He made a good recovery, and could, after the lapse of some time, walk a distance of twelve miles, with little or no inconvenience to his limb.

The first case submitted to operation in 1849 was that of a man, æt. 32, a weaver, who had been afflicted with disease of his knee-joint for four years. He recovered, and could walk without any support, although the parts were united by fibrous tissue; indeed, "a false joint existed." This patient died two years after of tubercles of the lung.

The second case in which the knee-articulation was removed in 1849, was that of a boy, æt. 6. He made rapid progress, and at the termination of the twelfth week he was enabled to leave off all mechanical support.

The following table consists of a summary of these seven cases, to which I am enabled to add two more, but regret I am not in a position to offer any detailed account of them, further than that both sank after operation.

TABLE II.

No.	Operator.	Sex.	Age.	Date.	Result.
1.	Jœger	M.	20	1830	Cured.
2.	Textor	..	..	1823	Cured.
3.	Textor	..	..	to	*Died.*
4.	Textor	..	..	1842	*Died,* the limb being amputated some time after excision.
5.	Lombardo ..	..	..	1842	*Died.*
6.	Lombardo ..	..	..	1842	*Died.*
7.	Heusser ..	..	..	1848	Cured.
8.	Heusser ..	..	..	1849	Cured.
9.	Heusser ..	..	..	1849	Cured.
9.				Total.	5 Cured. 4 Died.

Thus it will be seen that of these nine cases, five were cured with useful limbs; three died from the effects of excision, and one after amputation had been adopted, on account of failure of excision of the joint.

HISTORY OF THE OPERATION OF EXCISION OF THE KNEE-JOINT, FROM THE YEAR 1850 TO THE END (ABOUT NOVEMBER) OF 1860.

In the preceding pages I have endeavoured to give a limited but truthful sketch of the rise and progress of the operation of excision of the knee-joint, not only as practised in the United Kingdom, but as performed on the Continent. The results of this practice have been shown not to have been very satisfactory, and on this ground alone, I believe, that the proceeding for just twenty years—from 1830 to 1850—was allowed to remain unnoticed.

To Mr. Fergusson, of King's College Hospital, is undoubtedly due the praise for having revived an operation which has of late proved more successful in its adoption than it formerly did in the hands of bygone surgeons, and in those of, perhaps, less ardent admirers of its usefulness.

The following table records, as accurately as a most careful inquiry enables, the names of all those British surgeons who have performed excision of the knee-joint since the year 1850 up to the present time—November 1860; the number of times these operations have been undertaken, with the latest results as to their terminations, and the nature and extent of the disease, deformity, and accident, for which they were adopted. To obtain a still more correct idea of the results of these 238 operations, it will be advisable briefly to consider the principal features connected with them, for it is only by so doing that a just appreciation can be formed of those circumstances which induced the selection of excision in preference to amputation, and those causes which led either to success or disappointment.*

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* It is curious to observe that during the interval of twenty years—from 1830, about the date of Mr. Syme's second and unfortunate case of excision, to 1850—not only did surgeons fail to make trial of the proceeding so warmly advocated by Park, Moreau, Crampton, &c.; but writers on Practical Surgery whose works appeared during this and a previous period, either completely or partially abstained from even mentioning the operation, or, if they did honour it with their criticism, it was only to stigmatize and denounce it as a dangerous and improper introduction into surgery. Sir Charles Bell, in his "System

	NAME OF OPERATOR.	Number of Cases.	Undertaken for disease limited to the synovial and cartilaginous structures, and, if bones involved, only ulcerated.	Undertaken for synovial and cartilaginous disease, the bones being included in caries or necrosis.	Undertaken for disease, scrofulous or tuberculous, infiltrating the ends of the bones and destroying the joint.	Undertaken for Deformity.	Undertaken for disease, the nature of which is not specified.	Cured.	Died.	Amputated.	Recovered.	Died.
1.	Mr. Fergusson	21	6	10	1	3	..	10	11	..	..	..
2.	Mr. Jones	19	..	9	1	..	9	16	1	2	..	2
3.	Mr. Humphry	18	7	8	..	2	..	11	1	6	5	1
4.	Glasgow Hospital	11	9	2	..	..	..	4	4	3	1	2
5.	Mr. Erichsen	10	6	4	..	..	..	8	2	..	..	..
6.	Mr. Pemberton	7	3	4	..	..	..	4	3	..	..	..
7.	Mr. Price	7	..	3	2	2	..	4	2	1	1	..
8.	Mr. South	6	..	..	..	..	..	3	3	..	..	..
9.	Mr. Fearn	5	..	..	..	..	..	4	1	..	..	..
10.	The late Dr. Mackenzie	4	1	2	..	..	1	2	2	..	..	..
11.	Mr. Bowman	4	2	1	..	..	1	2	1	1	1	..
12.	Mr. Holt	4	3	..	1	..	..	2	1	1	1	..
13.	Mr. Page	4	2	1	..	..	1	3	..	1	1	..
14.	Mr. Simon	4	1	2	..	..	..	3	1	..	..	..
15.	Mr. Solly	4	1	2	..	..	1	2	1	..	..	..
16.	Mr. Spence	4	3	..	..	Accident 1	..	2	2	..	..	..
17.	Mr. Butcher	3	..	3	..	..	..	3	..	..	..	..
18.	Dr. Cotton	3	2	1	..	..	..	2	1	..	..	..
19.	Mr. Crompton	3	..	1	..	..	1	3	..	..	..	..
20.	Mr. Gore	3	1	..	..	..	2	3	..	..	..	..
21.	Mr. Hancock	3	3	..	..	..	..	3	..	..	..	..

22.	Dr. Keith	3	2	..	1	..	..	2	..	1	1	..
23.	Mr. Partridge	3	1	2	..	..	..	3	..	..	..	..
24.	Mr. Square	3	..	..	..	..	..	2	..	1	1	..
25.	Mr. Bickersteth	2	..	..	..	..	2	1	..	..	..	..
26.	Mr. Brotherstone	2	1	..	..	..	..	2	..	..	..	..
27.	Mr. Cadge	2	2	..	..	..	..	..	..	2	1	1
28.	Mr. Canton	2	..	..	..	Accident 2	..	1	..	1	1	..
29.	Mr. Clarke	2	1	1	..	..	..	2	..	..	..	..
30.	Mr. Coe	2	..	1	1	..	..	2	..	..	..	..
31.	Mr. Edwards	2	..	1	..	1	..	2	..	..	..	..
32.	Mr. Gant	2	1	1	..	..	..	1	..	1	1	..
33.	Mr. Greenhow	2	..		..	..	..	..	..	2	2	..
34.	Mr. Hey	2	1	1	..	..	..	2	..	..	..	..
35.	Mr. Hoffman	2	2	..	..	..	..	..	2	..	..	..
36.	Norwich Hospital	2	..	..	..	..	..	1	..	1	1	..
37.	Professor Pirrie	2	..	..	..	..	2	..	..	2	2	..
38.	Mr. Quain	2	1	..	..	..	1	..	1	1	1	..
39.	The late Mr. Statham	2	..	2	..	..	..	2	..	..	..	..
40.	Mr. Sympson	2	..	1	..	..	1	1	1	..	..	..
41.	Mr. Thomas	2	2	..	..	..	..	2	..	..	..	..
42.	Mr. Benfield	1	..	1	..	..	..	..	..	1	1	..
43.	Mr. Birkett	1	..	..	..	..	1	..	..	1	1	..
44.	Mr. Burman	1	1	..	..	..	..	1	..	..	..	..
45.	Mr. Brace	1	..	1	..	..	..	..	1	..	..	..
46.	Mr. B. Childs	1	..	..	..	..	1	1	..	..	..	..
47.	Mr. Craven	1	..	1	..	..	..	1	..	..	..	..
48.	Mr. Critchett	1	1	..	..	..	..	1	..	..	..	..
49.	Mr. Cumming	1	..	1	..	..	..	1	..	..	..	..
50.	Mr. Curling	1	..	..	..	..	..	..	..	1	1	..
51.	Mr. Cutler	1	..	1	..	..	..	1	..	..	..	..
52.	Mr. Eddison	1	..	1	..	..	..	..	1	..	..	..
53.	Mr. Edwards' friend	1	..	1	..	..	..	..	..	1	1	..

	NAME OF OPERATOR.	Number of Cases.	Undertaken for disease limited to the synovial and cartilaginous structures, and, if bones involved, only ulcerated.	Undertaken for synovial and cartilaginous disease, the bones being included in caries or necrosis.	Undertaken for disease, scrofulous or tuberculous, infiltrating the ends of the bones and destroying the joint.	Undertaken for deformity.	Undertaken for disease, the nature of which is not specified.	Cured.	Died.	Amputated.	Recovered.	Died.
54.	Sir J. Fife	1	..	..	1	..	..	..	..	1	..	..
55.	Mr. Firth	1	..	..	..	For injury 1	..	1	..	1	1	..
56.	Mr. C. Forster	1	..	..	..	..	1	..	..	1	1	..
57.	Mr. Fox	1	..	..	..	..	1	1	..	..	..	..
58.	Mr. Heath	1	..	..	..	1	..	1	..	..	..	..
59.	Mr. C. Heath	1	..	..	..	1	..	1	..	..	..	..
60.	Mr. Hughes..	1	..	..	..	..	1	1	..	..	..	..
61.	Mr. Hulke	1	..	1	..	..	..	1	..	..	..	..
62.	Mr. Hutchinson	1	..	..	..	..	1	..	1	..	..	..
63.	Mr. Kempe	1	..	1	..	..	..	1	..	..	..	..
64.	Mr. Kendall	1	..	..	1	..	..	1	..	..	..	..
65.	Mr. King	1	..	..	1	..	..	1	..	..	..	..
66.	Mr. Lawson..	1	..	..	..	1	..	1	..	..	..	..
67.	Mr. Lee	1	..	..	1	..	..	1	..	..	..	..
68.	Mr. Lansdowne	1	..	..	..	..	1	1	..	..	..	..
69.	Mr. Marcett..	1	1	..	..	..	..	1	..	..	..	..
70.	Dr. Masfen	1	..	..	..	1	..	..	..	..	..	..
71.	Mr. Maunder	1	..	..	1	..	1	..	1	..	..	..
72.	Mr. Mayo	1	..	..	..	..	1	1	..	..	..	..
73.	Mr. Mead	1	1	..	..	..	..	..	..	..	..	..
74.	Mr. Moore	1	..	..	..	1	..	..	1	..	..	..

75.	Mr. Moullin..	1	..	1	..	..	..	1	1	..	..	..
76.	Mr. Nicholls	1	1	..	..	..	..	1	..	..	..	..
77.	Mr. Pritchard	1	1	..	..	..	..	1	..	..	..	..
78.	Mr. Stanley	1	..	1	..	..	..	..	..	..	..	..
79.	Dr. Stewart..	1	..	..	..	..	..	..	..	1	1	..
80.	Mr. H. Smith	1	..	..	1	..	..	1	..	..	..	..
81.	Mr. T. Smith	1	..	..	..	1	..	1	..	..	..	..
82.	Mr. Symonds	1	..	..	..	..	1	..	..	..	..	..
83.	Mr. Tucker ..	1	..	..	1	..	..	1	1	..	..	..
84.	Mr. Tubbs ..	1	1	..	..	..	..	1	..	..	..	..
85.	Mr. Tatum ..	1	..	..	1	..	..	..	1	..	..	..
86.	Mr. H. Thompson ..	1	..	..	..	1	..	..	1	..	..	..
87.	Mr. Walton..	1	..	1	..	..	..	..	1	..	..	..
88.	Mr. Whipple	1	..	..	..	..	1	1	..	..	..	..
89.	Mr. Windsor	1	..	1	..	..	..	..	..	1	..	1
90.	Mr. Whorship	1	..	1	..	..	..	1	..	..	..	..
91.	Mr. Ure ..	1	1	..	..	..	..	..	1	..	..	..
92.	Mr. Tapp ..	1	1	..	..	..	..	1	..	..	..	..

Note to Table.—Since this was written, a large number of operations have been performed by some of the surgeons whose names are mentioned in the table, and I have been able to obtain the results of their practice. I think it well to make these additions, as a pretty correct indication will be furnished thereby of the statistics of the proceeding, and of its appreciation by the profession. Mr. Fergusson's additional cases have been twenty, so that altogether they amount to forty-one; of the last twenty operated on, there have been five fatal cases, making altogether fifteen deaths in forty-one operations.

I have had three operations in King's College Hospital, since the period alluded to, and of these three patients one died with symptoms of pyæmia soon after the operation. My colleague, Mr. John Wood, has had one case in the Hospital, but after a very patient trial, to preserve the limb, it was found necessary to amputate through the thigh in consequence of disease extending up into the femur. Thus the total number of cases occurring in King's College Hospital are fifty-three operations; and adding my own fatal case, and that of Mr. Bowman to Mr. Fergusson's, there have been seventeen deaths altogether. This appears to be a large mortality, but it will be seen that the death-rate was large only in the early periods of the operation; for, out of the first twenty-four cases in one Hospital, exactly one-half died, whilst in the last 29 cases only five deaths have taken place. Amputation has been resorted to in three cases, each of which has recovered.

Mr. Edwards has had, in addition to the two cases mentioned by the author, fourteen operations, making sixteen in all; of these two have died, and with the exception of two more of the cases, all are moving about with useful limbs.

Dr. Humphry, of Cambridge, had, according to the table, operated on eighteen patients; since this period he has operated upon fourteen other cases, making thirty-two in all; out of which number, six have died, three of them from the excision, three after amputation performed subsequent to excision: in five others amputation was resorted to and recovered; this leaves twenty-one patients with useful limbs.

I make no reference to many other cases which have been operated upon by various surgeons, as it is not my purpose to enumerate all the instances where excision of the knee has been performed. I have contented myself with mentioning the additional cases which have been performed by those surgeons whose names are in the table.—H. S.

A critical analysis, necessarily somewhat brief, of these operations and their results may, perhaps, be best accomplished in the following way:—

[*Continuation of foot note on p.* 61.]

of Operative Surgery founded on the Basis of Anatomy," published in 1807, does not even mention the subject. Delpech, in his "Précis élémentaire des Maladies réputées Chirurgicales," (Paris, 1816,) expresses himself, without any practical experience, opposed to the treatment of caries of the articular ends of bones by excision. (Tome iii. p. 374.) Mr. Liston, in his "Elements of Surgery," says that "there are few surgeons so rash as to have recourse to this operation. In short, the results of excision of the knee-joint do not justify its repetition." (London, 1831. P. 401.) "Excision," writes John Lizars, "is performed instead of amputation, in the young subject; and in this country is now properly limited to the shoulder and elbow joints." (A System of Practical Surgery. Edinburgh, 1838.) Sir George Ballingall writes, in his "Outlines of Military Surgery,"—"Excision of the knee-joint is an operation which I have twice witnessed for chronic disease; and although one case was successful, it is not an operation which I consider advisable in any case of recent wound, or hardly in any case whatever." (2nd edition. 1838. P. 343.) In America the operation was also held in no esteem whatever; for in the year 1844, Professor Pancoast adduced several theoretical "reasons," which he thought ought to counter-indicate the operation in scrofulous affections of the joint. (A Treatise on Operative Surgery. 1844. P. 129.) I have quoted these abstracts from among many which may be selected from the writings of eminent practical surgeons, to show how deep-rooted was the prejudice against an operation in the performance of which the authors themselves had had no kind of experience.

1. Mr. Fergusson's twenty-one cases.

No. of Cases operated on.	Cured.	Deaths from various causes.
21	9	11

Of the twenty-one cases operated upon by this surgeon, eleven occurred in females, and ten in males. The age of the youngest patient was three years and a half, that of the eldest thirty-five years.

The earliest period at which the operation was undertaken after the occurrence of disease was at the eleventh month; the most remote, after nine years and a half.

Of these twenty-one cases, nine were cured with useful limbs, the degree of utility varying, however, according to circumstances. Thus, in one case (chronic synovial disease, &c.), to be hereafter more particularly spoken of, a young woman had her knee-joint excised in March 1856, and the anchylosis is one which admits of very considerable motion. The girl has at the present time a most useful limb, and is employed as a hard-working servant. The last time I examined the limb, osseous material had been, in no appreciable way, generated. This examination was made nearly three years ago.*

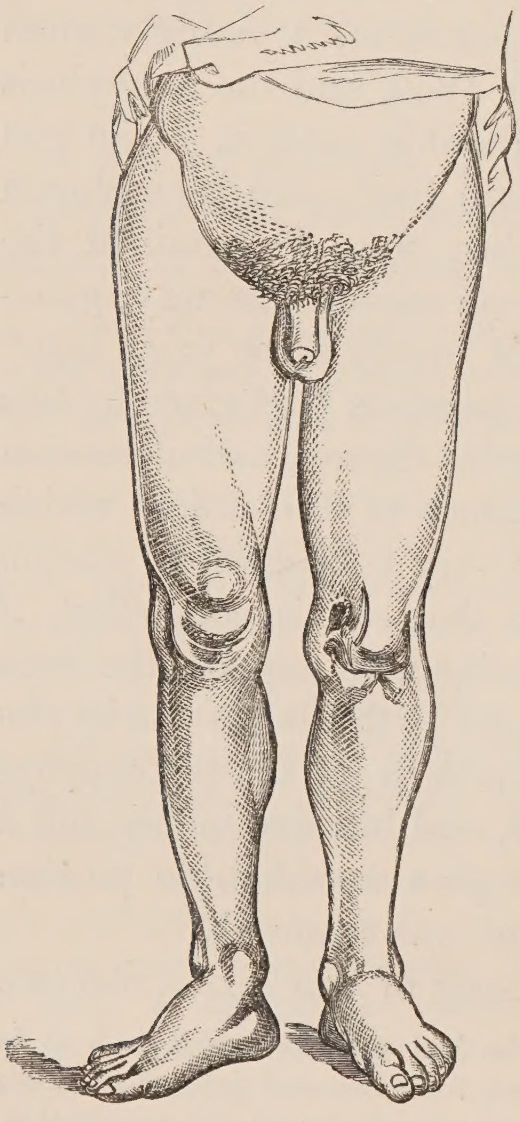
In another instance, the second operation performed by this surgeon (1852), on account of synovial disease, and ulceration of the articular cartilages, the nature of the union which has resulted is entirely fibrous, and very considerable motion is allowed at the present time; so that she is compelled, if wishing to undergo any unusual fatigue, to support the limb with an iron side-rod, fixed at one end to the pelvis and by the other into her boot. The limb, as is seen by the accompanying photograph,† is well nourished, and but five inches and a half shorter than its fellow, although a considerable portion of both bones forming the knee-joint was removed.

But by far the most interesting cases of this series, are two

* Soon after this was written, this girl, who had such an useful limb as to permit of her performing the duties of servant, fell down and injured the knee so severely, that destructive inflammation came on and necessitated amputation, from which she recovered. As the author states, prior to the accident the operated limb was eminently serviceable, although the union at the knee was only fibrous.—H. S.

† Here a drawing, furnished by the author, is omitted.—H. S.

in which not only was the knee-joint in each extensively disorganized, but the shafts of the femora implicated to a considerable distance by necrosis. The operative measures adopted were of two distinct kinds, and extended over separate periods of time. In the first case, a boy, æt. 13, injured his knee and lower part of his thigh, in the latter part of November 1856. On November 14th, 1857, a large necrosed portion of the lower end of the femur was removed, but the diseased knee-joint was not interfered with. At this time the leg was flexed on to the thigh. Reparation having taken place on December 5th, 1857, the knee-joint was excised, and in February (22nd) he was sent to Margate, where he remained under my occasional notice. At the end of one year, the lad had a most useful limb, and it now enables him to carry on his occupation with little detriment. The other case was that of a little girl, and was so similar in all respects that I shall not record the particulars: suffice it to say, that she made a most excellent recovery, and has a very tolerable limb.



A lad of the name of Gasson, æt. 18, when operated on in 1856, on account of pulpy degeneration of the synovial membrane, and ulceration of cartilages of long standing, deserves passing notice on account of the rapidity of cure by osseous anchylosis of the ends of the bones forming the knee-joint. In six weeks bony junction had taken place to such an extent as to allow of his being moved from the bed; in two months he could walk, and now, four years after the operation, he is all day engaged in a laborious occupation, and makes no inconsiderable use of his limb, which, although two inches and a half of bone were removed, is but very slightly shorter than its fellow, merely necessitating the use of a thickened sole to his shoe. The limb, well developed and of perfect symmetry, is shown in the woodcut on the preceding page, taken from a cast in the King's College Museum.

From these highly successful instances of conservative surgery, we must turn, although unwillingly, to results by no means encouraging, and inquire how the rate of mortality, so disproportionately high, is to be accounted for. In twenty-one instances of the operation, ten died more or less immediately from the effects of the proceedings.

1st. The first instance (indeed, the first case in which the operation was performed), a man, æt. 21, who for years had laboured under synovial disease of the joint, combined with ulceration of cartilages, sank on the eighth day after operation, of pyæmia.

2nd. A young woman, æt. 28, suffering from the same disease, died, at the time I was dresser, of pyæmia on the sixteenth day. I mention this case in the way I have done, because I intend to draw one or two practical deductions from it.

3rd. A young woman, æt. 26, died on the sixteenth day after operation, of pleurisy.

4th. A woman, two years older, operated on in October, 1856, on account of extensive disease of the joint, including the bony portions, sank on the forty-third day, of exhaustion.

The water-colour drawing* will illustrate the extent to which the end of the femur was infiltrated, or occupied by limited abscesses.

5th. A man, æt. 35, suffering from disease principally confined to the synovial and cartilaginous structures, underwent the operation of excision, November 5th, 1858, and fell a victim to pyæmia on the eleventh day.

6th. A man, æt. 21, a good subject apparently for the operation, and the bones not diseased, died on the thirteenth day. Suppression of urine was the chief destructive symptom.

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* Here a drawing sent in by the author is omitted.—H. S.

7th. A woman, æt. 31, for nine years and a half had suffered from disease of the left knee: the joint was irretrievably destroyed. Excision was performed, July 18th, 1857, under the influence of amylene. One hour and a half after, the patient was removed to bed. Chloroform was administered for the purpose of painlessly adjusting the patient's limb to the required apparatus. Considerable depression and languor followed, from which she never rallied, but died at 10 P.M. on July 21st.

8th. A little girl, æt. 6½, with disease of three years' standing, was operated upon at two o'clock on July 22nd, 1857. On removal to her bed, the limb was allowed to remain at rest till six o'clock, when chloroform was re-administered for the purpose of placing it on the necessary splint. The child, already much shaken by the operation, sank at 9 P.M.

I have no doubt whatever that the death of these two patients was, in a measure, attributable to the extra-administration of anæsthetics, combined with the shock necessarily resulting from the operation.

9th. A man, æt. 39, had his knee-joint excised on 14th August, 1858, on account of diseased joint, including all component structures. He died August 25th, 1858, of pyæmia. Suppurations were found in various parts of the body, but especially in the left pleuræ and left kidney.

10th. This case, although it ended unfavourably, is, nevertheless, very interesting. A woman, æt. 35, the subject of extensive disease of the knee-joint, and labouring under an advanced state of phthisis, was submitted, on account of the urgency for surgical measures, to excision of the vitiated articulation. Great relief was afforded for a time, but she eventually fell a victim to an acute attack of the lung mischief.*

11th. The last instance in which death resulted, as a sequel of the operation, was in a man, æt. 27, who for years had suffered from articular disease. The operation of excision was performed on October 31, 1857. Improvement followed, but in three months and a half the parts immediately concerned in the operation became enlarged and painful. Abscesses formed which denoted mischief about some bony structure. When under the influence of chloroform, the patella, which had been left, was found necrosed, and removed. This afforded relief, but the patient never seemed to rally, but gradually sank on May 6th, 1858. No fitting union had taken place between the bones.

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* The author has very properly mentioned this as a fatal case; still she recovered from the operation, the wounds being almost entirely healed, as three months had elapsed from the period of the excision.—H. S.

Further comment on these cases I shall reserve till the causes of death following excision of this special joint are discussed at length. I may, however, take this opportunity of stating, that I witnessed the operations and treatment of all the cases, with the exception of the first, and that the facts and results here stated are derived from my notes, and not from any printed records. And so with other cases, which I shall have to mention, occurring in the practice, not only of my former teachers, but in that of various surgeons who have allowed me the great advantages of seeing their operations and collecting much useful information.

The following table exhibits at a glimpse the various causes of fatal results in these eleven cases.

Pyæmia	4
Pleurisy	1
Exhaustion	2
Suppression of Urine	1
Chloroform and Shock	2
Phthisis	1
	11 deaths.

2. Mr. Jones's nineteen cases.

No. of Cases operated on.	Cured.	Died.	Amputated.	Died.
19	16	1	2	2

Of the sixteen instances in which the operation was performed, more or less useful limbs were preserved to the patients, who were of ages varying from 5½ to 35 years. This excellent surgeon, writing to me lately, says:—" I am satisfied that some of my sixteen successful cases have had shorter limbs; that is, have not kept pace with the excised one, but this has not always been the case; and if the limb has been some five or six inches shorter, still it is far better,—very, very far better, than a wooden one."—(*Extract*) *Letter, Dec.* 4*th*, 1860.

In several of these cases, so successful in their results, one of the chief features has been the rapidity with which reparation has taken place. But in no instance in which the operation has been performed has the success been more gratifying than in the case of a girl, Mary Noel, æt. 8 years, who not only had a large portion of the joint-ends removed, but likewise the head of the fibula, and a large sequestrum from the upper third of the tibia. This operation was performed on August 20th, 1855, and in October of the following year an impartial observer, who has seen much of these operations, says that "It is the best case I have seen, considering the amount of disease taken away."

In several other instances complications existed, but each difficulty was successfully overcome.

With regard to the single death which immediately followed excision of the articulation, it cannot be said that the fatal result was altogether dependent on one or other of those causes which occasionally lead to an unfortunate termination after operations of magnitude. The patient, a lady, thirty years of age, sank on the thirteenth day after operation (performed September 4th, 1851), of epidemic dysentery.

Of the two cases which required amputation, I have no special data; and in the list of cases forwarded to me by Mr. Jones, no particular mention is made of them.

3. Mr. Humphry's eighteen cases.

No. operated on.	Cured.	Died.	Amputated.	Recovered.	Died.
18	11	1	6	5	1

For this table I am indebted to the kindness of Mr. Humphry; and also for various details and sketches of limbs after excision of the knee-joint, I have to thank him.

Seven of these eighteen patients were females, and eleven males. The age of the youngest was five years; that of the eldest forty years.

The most striking feature connected with the history of these eighteen cases is the number of amputations which were necessitated after excision of the joint; no less than one-third of the entire number being subjected to the proceeding, at periods varying from the eleventh day to the tenth month after removal of the articulation.

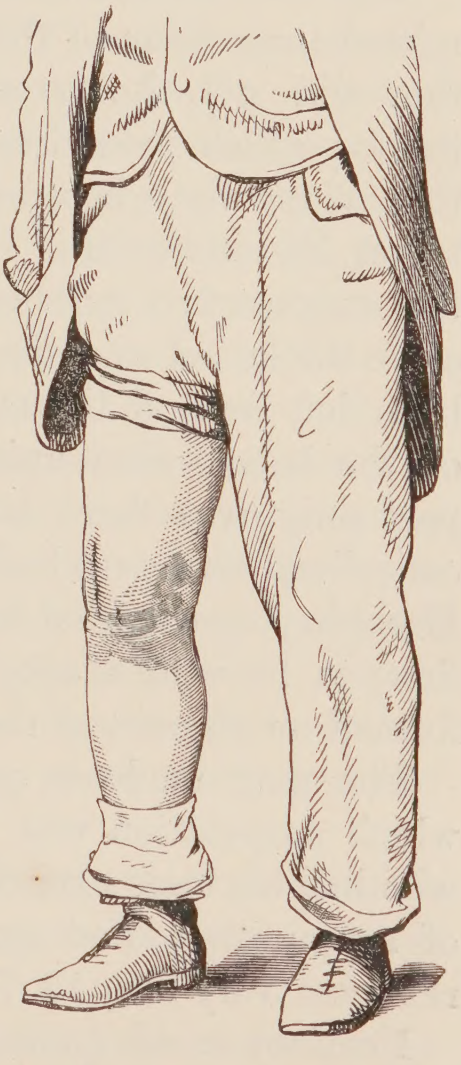
But, in the first place, we must briefly consider one or two of the most interesting cases, eleven in number, which recovered with limbs more or less useful.

As already seen in seven instances, the disease was limited to the synovial membrane and cartilages of articulation. Of these cases, four were cured, with good and useful limbs.

In eight instances the ends of the bones were involved in disease, not simply ulceration; and of these, five made good recoveries.

Mr. Humphry has forwarded to me a photograph of one, which will be found to show a most admirable result. (See woodcut annexed.)

I think I have never seen a more excellent result than that which has followed the operation performed on W. K., æt. 25, in May 1857. The photograph was taken in August 1860, and shows a limb in size and utility slightly inferior to its fellow.



In the other two cases represented, the same admirable success has been obtained.*

In two instances in which the operation was undertaken on account of deformity, both were cured with useful legs.

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* Drawings of these cases have been omitted.—H. S.

One case was that of a man, æt. 47, who, several years prior to his admission into Addenbrooke's Hospital, had fractured his left patella. The joint was excised April 19th, 1855, and in fifteen months he was able to walk about and traverse twenty miles of ground in the course of the day.

The second example was that of a little girl, æt. 10: the wound healed almost by first intention, and in a few months she had a most serviceable limb.

Of those cases in which *amputation* was considered needful:—

In three examples it was necessitated after excision had been performed on account of disease limited to the synovial and cartilaginous structures.

The first case was that of a man, æt. 20, who was submitted to excision of the joint on July 18th, 1856. Reparation did not, however, progress satisfactorily; abscesses formed which proved more and more refractory, till amputation of the limb became the last expedient—it was resorted to on November 4th, 1856. It is important to observe that the suppurative mischief was traceable to the existence of some thickened and diseased synovial membrane, which had been left around the extremities of the bones. The edges of the bones were united by tough fibrous tissue: at one part only was there any ossific matter to be found. The cancellous structure had undergone some rarefications. Mr. Humphry states, that he did not consider this case, from the first, to be well adapted for excision, but that it was performed on account of the patient refusing amputation.

The man made a quick recovery. The second case in which amputation was expedient was that of a boy, æt. 10, who had his knee excised, April 24th, 1857; but on account of suppuration, and general failing in health, the limb was removed July 5th, 1857.

I cannot avoid quoting the operator's remark founded on examination of the parts after removal, because it shows the desire to afford all true information regarding his numerous cases of excision:—" The condition of the part was not so bad as I had expected. There was no ulceration or necrosis of the bony surfaces; on the contrary, they were united with considerable strength by tough areolar tissue, in which, doubtless, a firmer medium would soon have been developed."*

The third instance in which amputation was resorted to after removal of the joint, was in the person of a man, æt. 35. On the 15th May, 1857, the articulation was excised. "The synovial membrane was thickened, and firm white growths, many of them polypose, covered its interior and hung down into the joint; some of them were of large size. The cartilages were generally thinner than natural; in some places they were quite removed, and in others they were perforated by small, smooth circular ulcers. The bones were healthy."† After the operation he did not progress favourably, but became haggard, and suffered from diarrhœa. Continuing to decline, the limb was amputated, Aug. 29th, 1857; and he recovered. The reason this excellent surgeon gives, for having resorted to the amputating knife, appears to me so strange, and so opposed to my own opinions and practice, and also to what I have seen adopted on somewhat similar occasions, that I quote Mr. Humphry's own words: "Although the limb was in an improving state, and there was nothing apparent in its condition to forbid the hope of its being a useful member, yet, as he remained so weak, and as another attack of diarrhœa was *threatening*, I amputated on August 29th." On "examining the parts after amputation, we found the cut ends of the bones covered with granulation structure, which formed a soft, uniting medium between them. There was slight superficial ulceration at one or two points, with sinuses running from them; *but no disease, either of the bones or soft parts, which appeared sufficient to have prevented recovery.*"‡

At a future part of this Essay I shall make further allusion to this and other cases, in which amputation was adopted after excision had been performed.

In three instances in which amputation was needed after failure of excision of the joint, for disease both of the soft and hard structures, two patients recovered and one died.

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* Med.-Chirurg. Trans., vol. xli.

† Op. cit.

‡ Op. cit.

The italics are my own, and are designed to show what I consider to be suspicious and unnecessary fears and practice.

The first case was that of a female, æt. 23, whose joint was excised, March 27th, 1857. Soft union had taken place in four weeks, but ulceration and suppuration continuing in the neighbourhood of the parts, amputation was resorted to on January 22nd, 1858. The patient made a good recovery. It is interesting to observe, that the union which obtained during these ten months was of a mixed character. The inner halves of the cut surfaces of the tibia and femur were united by means of "firm bony union," while the outer halves were separated "by a narrow interval, which was occupied by soft lymph and pus."

In the second instance, in which a favourable result was obtained, after amputation of the thigh, the patient, a man, æt. 25, had had his knee-joint excised for disease of both soft and osseous structures. The thigh was amputated on account of irritation and abscesses, on the thirteenth week, and the man was rapidly bettered, and left the hospital with a serviceable stump.

The third case, in which amputation was resorted to after excision of the knee-joint, was in a man, æt. 40. Amputation through the thigh was performed on the eleventh day after excision, but the patient unfortunately sank on the fourth day.

The only case which sank after excision of the articulation, was that of a little girl, æt. 5 years. Her case was a most unfavourable one. Acute suppuration of the joint set in a few days after admission into the hospital. Excision was performed May 9th, 1857, but the child sank June 1st.

In the history of these various operations, which I have thought advisable to give at length, are to be traced many interesting features; and numerous are the criticisms which can be made upon the mode of practice adopted in more than one instance. I shall, however, reserve any remarks thereon until I come to notice the operative proceedings, the importance of selecting with judgment cases in which to apply the operation, and the requisite care that is needed in the after-treatment, to prevent the occurrence of various annoyances which by suitable attention can be avoided.*

4. The Glasgow Hospital eleven cases.

No. operated on.	Cured.	Died.	Amputated.	Recovered.	Died.
11	4	4	3	1	2

Thus out of eleven cases operated upon only four made recoveries with useful limbs; four died from the effects of the operation; in three, amputation through the thigh was required, and of these three two recovered and one died. The age of the youngest patient was 8 years, that of the eldest 35 years. The longest period that disease had lasted was six years, the shortest one year. In nine instances the synovial and cartilaginous structures were alone involved; in the remaining two the bony ends were likewise included. All the published information which I can obtain of these cases, is published by Dr. E. Watson, in the *Glasgow Medical Journal* for October, 1859. From Dr. Watson's statements it would appear that three patients, aged respectively 12, 23, and 14 years, died at periods of twenty-nine, fifteen, and thirty days after operation; the immediate cause being *shock*. The fourth case, a patient æt. 35, sank from diarrhœa on the twenty-fourth day. In the cases (three) in which amputation was necessitated, hectic fever in two, viz. in patients æt. 19 and 18 years, was the cause; while in the remaining example, "exhaustion, and the *pain from dislocation which had occurred, were the urgent, the urgent circumstances!*"†

5. Mr. Erichsen's ten cases.

No. operated on.	Cured.	Died.
10	8	2

Mr. Erichsen informs me by letter, that up to March 1859, he had excised the knee-joint in nine instances, and that in eight the operation was successful, so far as life was concerned, and in several a more or less useful limb was left. The remaining case proved fatal from an attack of erysipelas, by which several patients, at the same time in hospital, suffered. The tenth case of this series I saw operated upon, and it was interesting because the joint was removed on account of very extensive suppuration which had filled the articulation. This patient unfortunately died some days after the operation, of irritation, hectic and pulmonary phthisis.

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* I think it only fair to state that many of the facts which I have here recorded have not only been deduced from Mr. Humphry's private information, but from his excellent paper published in Med.-Chir. Trans., vol. xli.

† The italics are my own, and in the last instance are intended to show that the immediate cause for amputation was probably owing to want of more skilful after-treatment.

Four of the cases operated upon were in consequence of disease involving both the hard and soft articular structures; in five the mischief was confined to the synovial and cartilaginous tissues; while in the remaining one, suppuration, rapid and extensive, necessitated the proceeding.

One of the cases which recovered with a good limb deserves passing notice, because only the heads of the tibia and patella were meddled with. The end of the femur was quite sound. The case was operated on, October 11th, 1854. The great success obtained by this surgeon has led him to prefer the operation to amputation in the majority of diseased conditions of the knee-joint (not malignant), for which amputation is in general adopted.

Another case operated on, which is also worthy of remark, is that of a boy, æt. 16, who had his knee (left) removed two years and a half ago. Mr. Erichsen informs me that "the lad has now an excellent limb, and with perfect ease and strength can walk six or eight miles a day."

6. Mr. Pemberton's seven cases.

No. operated on.	Cured.	Died.
7	4	3

All these seven operations were undertaken for disease involving the articulation. In three instances the synovial and cartilaginous structures were alone affected, while in the remaining four the bones were likewise involved. The age of the youngest patient was seven years, that of the eldest thirty years.

Of those who suffered destruction of the joint by reason of the mischief being confined to the synovial and cartilaginous tissues, two were cured and one died. Of the two patients who recovered, one, æt. 17 years, had a useful member with some degree of motion between the cut ends of the bones, at the eleventh month; while anchylosis in the other did not obtain till nearly two months had expired.

The patient that died was a woman, æt. 30; she sank shortly after the operation, partly from the effects of the chloroform which was administered to save the pain of the operation, and partly from shock.

Of those cases in which excision was employed on account of the diseased action, including both the synovial and osseous structures, two were cured and two died. One of the cases which was cured is especially interesting, as considerable arrest in development was apparent some years after. I shall state the principal features of interest relating to it when discussing the influences which the performance of this operation exerts over the nutrition and development of the lower limb. The other case was cured, not, however, till it had struggled against a severe attack of secondary hæmorrhage, which occurred on the sixth day after the operation.*

7. The author or "Spero's"† seven cases.

No. operated on.	Cured.	Died.	Amputated.	Recovered.	Died.
7	4	2	1	1	0

These seven cases, as it happens, are representative illustrations of the various forms of disease and deformities for which the operation of excision of the knee-joint has been usually undertaken; and I shall, therefore, defer further mention of them till a future portion of this Essay, when the particulars of each will be fully narrated.‡

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* British Association Journal.

† Mr. Price adopted the word "Spero" as his motto to accompany the Prize Essay.—H. S.

‡ *Vide* Appendix.

8. Mr. South's six cases.

Operated on.	Cured.	Died.
6	3	3

Of these six cases, perhaps the most interesting are the following. The first, a woman, æt. 40, who for years had suffered from "incurable" disease of the knee-joint. In preference to amputation, the removal of the joint was undertaken, and although the case did not, at first, proceed very satisfactorily, owing, I believe, to the non-application of a suitable apparatus, yet the patient got quite well, and is now walking about and actively employed. The leg is placed at a somewhat acute angle to the thigh, but is still a very useful member. The next case is that of a boy, æt. 11, who had his knee-joint excised in June 1859. The disease was of four years' duration. In the operation that was performed, merely a thin slice of the femur and tibia was removed, and the patella scraped. There was some necrosis of the external condyle. I beg particular attention to the fact, that merely *thin slices* were removed from the particular ends of the two bones, and the patella but partially cut away, because the very moderate removal from the ends of the bones of important anatomical and physiological structures is, as far as my own experience enables me to judge, a feature peculiar to Mr. South's plan of operating. On this point I shall have more to say hereafter. But to return. Through the kindness of this surgeon I had the opportunity of examining the limb from which the knee-joint had been removed nearly fourteen months before, and I copy from my note-book the impression it gave me at the time:—"Now there is apparently firm bony anchylosis. By only the thickness of a shilling is the limb shorter than its fellow, as he stands in the erect position. The femur and tibia are not quite in a straight line, but meet in a slight angle. The front of the femur is somewhat bowed; the tibia is also somewhat dislocated outwards. The lad walks without even a halt." (Sept. 1st, 1860.) Some idea of this case may be obtained from Photograph No. 2, Illustration No. 21.*

* This drawing has been omitted.—H. S.

In another instance the patient was a lad about the same age, and the same beneficial result has followed the operation, performed in exactly the same manner.

These three cases form the successful instances.

Of the three which died, one presented some features of interest. I saw this patient occasionally, when in St. Thomas's Hospital. On the 29th of August, 1860, he was under treatment, the limb having been operated on six weeks before. At this time he was in a very shaky condition. The tibia had become partially luxated inwards and somewhat behind the end of the femur, but otherwise it was in a good position. The man, who was twenty-two years of age, subsequently died. This luxation inwards and backwards I particularly noticed, because it is of very common occurrence, and one which even extreme care will not always prevent.

9. Mr. Fearn's five cases.

Operated on.	Cured.	Died.
5	4	1

These cases, as far as I am aware, have never been publicly recorded, and, therefore, I transcribe the account I received of them from Mr. Fearn, in a letter dated September 15th, 1860:—"I have now excised the knee-joint in five cases, all of which, with one exception, have been in young subjects. All the cases have been of the usual description,—strumous arthritis going on to suppuration, ulceration of the cartilages of the joint, caries of tibia or femur, or both, and the ordinary deposit and thickening about the joint.

"Three cases, in which the ages were respectively about twelve, nine, and eight years, have been entirely successful—the general health being fully restored, and a useful limb being preserved to each. One, an adult female, æt. 26, of very strumous habit, and who had refused to submit to the operation till there appeared to be scarcely a possibility of success, died six months after the operation, exhausted by profuse suppurative discharge. The limb ought, many weeks before her death, to have been amputated, but she obstinately refused to submit. My fifth case, a little girl, æt. 7, I operated upon a fortnight since, and I have to-day removed and re-applied the splint and bandage. A considerable amount of union has taken place, and the case is in all respects progressing most favourably. I feel no doubt of a successful result.

"I need scarcely say that I entertain a high opinion of the operation."

I pass over these remarks without observation, as the admirable success speaks for itself,—admirable, because four cases succeeded out of five; and the fifth was one which, in all probability, would have terminated in the same way, had amputation been performed.

10. The late Dr. Mackenzie's four cases.

Operated on.	Cured.	Died.
4	2	2

There is nothing particular to remark about any of these cases, except it be, that in the first instance in which the operation was performed (a man, æt. 42), in February 1853, the greatest difficulty was experienced in maintaining the bones in apposition; and that, although various circumstances occurred to protract his convalescence, a good recovery was eventually obtained. In another case in which amputation would have been the wiser operation, excision was adopted, and the patient died of exhaustion and diarrhœa. The remaining unsuccessful case died of pyæmia on the twelfth day. The second case, which turned out well, appears to have been in every way a satisfactory one.* In all these cases, a very considerable proportion of bone appears to have been taken away; indeed more than occasion seems to have required.

11. Mr. Spence's four cases.

Operated on.	Cured.	Died.
4	2	2

Regarding these cases, I do not think I can do better than quote the letter I have received from Mr. Spence, dated Edinburgh, Nov. 14th, 1860, wherein he states: "I may state that I have as yet performed excision of the knee-joint very seldom—only thrice for disease of the joint, and once, many years ago, for a compound dislocation; the last mentioned case was complicated by other severe injuries, and proved fatal, but can scarcely be counted a fair case for the operation. Of the three cases of disease in which I have performed it, two have proved excellent cures; in both there is wonderfully little shortening, and the patients say they walk more

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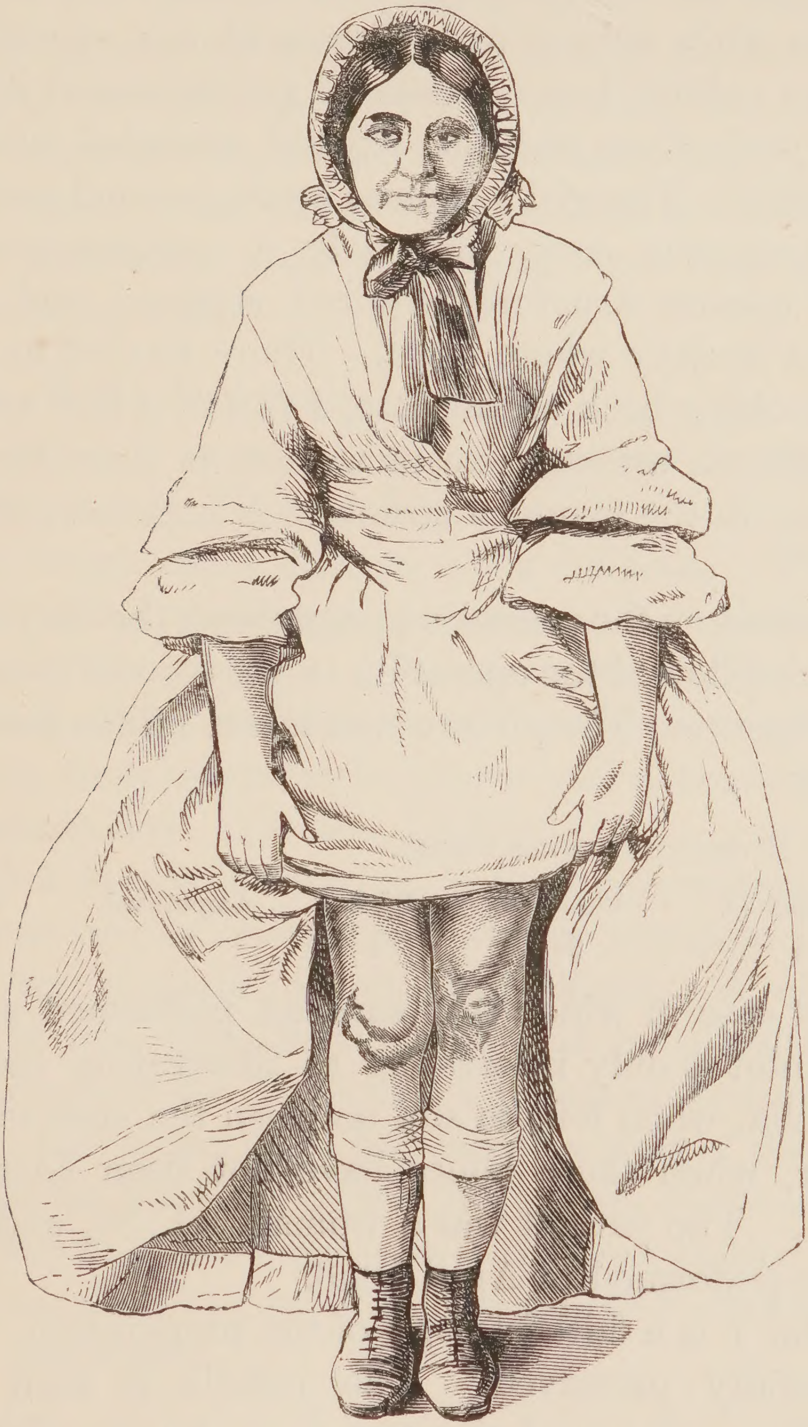
* Medical Journal (Edinburgh) of Science. June, 1856.



comfortably with an ordinary shoe, than with a raised heel. There is, indeed, very little perceptible halt in walking.*

"The third case, on which I operated last winter, proved fatal on the ninth day from pyæmia. The disease was extensive ulceration of the cartilages and bones, especially of the head of the tibia, arising from disease of the synovial membrane, from which large masses of pedunculated bodies and fimbriated projections had long existed, attended latterly with excessive pain. The girl's general health seemed pretty good; the operation was easy, and only a comparatively small amount of osseous structure required removal, and was condensed, and healthy where sawn. There was not much bleeding; and looking back on the case, I feel at a loss to find any cause of pyæmia arising, except we are to infer that disease commencing in the synovial structure is unfavourable for this operation."

The woodcut on the preceding page shows the very admirable result which followed the operation in the second case operated on by M. Spence. The picture was taken fifteen months after operation.†

11. Mr. Bowman's four cases.

Operated on.	Cured.	Died.	Amputated.	Cured.
4	2	1	1	1

The first case in which this surgeon performed excision of the knee-joint is only interesting as illustrating the liability of the patella, when left, to slip between the ends of the tibia and femur, when those bones have not been kept quite in apposition. The patient was a woman, æt. 30, and the operation was performed in April 1856.

Plate No. 7 is a faithful copy of the preparation, which has been carefully preserved. The patella is seen impacted between the surfaces of the two long bones. The patient died from exhaustion and irritation after some months.

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* These cases are published in "Report of Clinical Cases." Edinburgh, 1859. By James Spence. 1860.

† I shall not in making my statistics take into account the first case here recorded, as I have no further information of it either as regards the date of its performance, and its subsequent treatment.

In the second case, that of a girl æt. 16, the joint was removed on account of disease of both soft and hard structures, November 1st, 1856. Considerable difficulty was experienced in keeping the bones in apposition: irritation of their extremities, and the consequent lighting up of unhealthy suppuration, induced necrosis of the lower end of the femur, so that amputation was needed after some weeks; but the patient, although much reduced, made a good recovery.

In the history of the other two cases, both of which recovered, I find no particulars worth recording, save they both turned out remarkably well.*

12. Mr. Holt's four cases.

Operated on.	Cured.	Died.	Amputated.	Recovered.
4	2	1	1	1

Two of these cases deserve a few remarks. The first, as being the oldest patient, a woman æt. 47, submitted to the operation in this country. The operation was performed on August 24th, 1855, on account of "persistent disease;" and the woman, from extensive bed-sores and exhaustion, sank on the eighteenth day. (*Lancet*, 1856.)

The other case is interesting, because amputation was necessitated some two or three months after excision, on account of caries and suppuration about the joint. A considerable quantity of new bone was thrown out in spiculæ from the circumferences of the bones, but no adequate or corresponding reparation had taken place between the ends of the bones.

Through the kindness of Mr. Holt, I am enabled to present a pencil-sketch of this very interesting preparation (Drawing No. 2, Illustration 25).† The case did well after amputation had been performed.

13. Mr. Page's four cases.

Operated on.	Cured.	Amputated.	Recovered.
4	3	1	1

Regarding these cases I have nothing particular to say.

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* I had the opportunity of watching the operations on, and treatment of, three of these cases.

† This drawing has been omitted.—H. S.

The three individuals who were cured had excellent and useful limbs, and, what is interesting, the nutrition of the member from which the knee-joint was removed, has in every instance kept pace with that of the corresponding limb.

Mr. Page has been kind enough to give some particulars of the case which was amputated. The patient was twenty-three years of age, and had suffered for some considerable time with disease of the joint. Excision was performed by a surgeon, a friend of Mr. Page, January 7th, 1855, but amputation was resorted to by Mr. Page, on June 29th, 1855, on account of non-union, necrosis, and displacement of the cut ends of the bones. The patient made a good recovery.

14. Mr. Simon's four cases.

Operated on.	Cured.	Died.
4	3	1

As these cases have not all been publicly recorded, and are not, therefore, generally known, I transcribe a letter received from Mr. Simon, December 4th, 1860:—" I have within the last few days lost, by pyæmia, a patient whose knee-joint I had excised about three weeks previously. Before that I had had three excisions, all successful. One of the patients, however, had managed some months after the operation to injure himself so severely by a fall, breaking the anchylosis and tearing the cicatrix, as to render amputation necessary. This is all the personal experience of true excision of the knee I have had.

" Some years ago, before excision was much talked about, I operated (unsuccessfully, for the man died of pyæmia) on a patient whose knee-joint had been bonily anchylosed at a right angle."*

15. Mr. Solly's four cases.

Operated on.	Cured.	Died.	Progressing.
4	2	1	1

Mr. Solly first commenced to perform this operation in

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* I have not included this case in my statistics, as this is the first intimation I have received of it.

1859; and judging from his remarks, published in a clinical lecture by the *Lancet*, in 1859, there can be but little doubt that he entertains a favourable opinion regarding it.

The first case was a boy, æt. 6 years, whose knee-joint was greatly diseased, and the history of it is interesting because *considerable* bony union had taken place as early as three weeks after removal of the articulation.

The second case was very similar in all respects.

The third case was that also of a lad, æt. 10, who had synovial and cartilaginous destruction of his joint. Excision was performed, but the limb did not appear (I had the opportunity of seeing this case on several occasions) to make much progress; and as the cure, as far as I am aware, is not yet complete, I have placed it in the above table as "progressing."

The last time (Aug. 29th, 1860) I saw the case, it appeared to me that the tibia had fallen too low, and the end of the femur was tilting up too high to allow of the cut extremities lying in contact. This condition is, as will be more especially stated, of *very* frequent occurrence, and must always be guarded against. The case, which terminated fatally, did so on account of "rapid phthisis," when the wound had nearly healed and anchylosis was partly completed. (Vide *Lancet*, vol. i., 1859.)

16. Mr. Butcher's three cases.

Operated on.	Cured.	Died.
3	3	0

The histories of these three cases are to be found fully and carefully related in the various memoirs of Mr. Butcher on excision of the knee-joint. In each the disease was considerable, and the recoveries are among the most satisfactory of all that have taken place.

The results of the first case, operated on in January 1854, and of the second, operated on in 1855, are well shown in Photographs Nos. 2 and 4, Illustration 23, which are copies of drawings made under Mr. Butcher's own superintendence.

It will be seen, the shortening in both instances is comparatively slight, and the limbs are well developed.*

I particularly wish to draw attention to these cases, because they were not treated in an apparatus such as I myself first described, and which is now, I may almost say, in constant use, but in one peculiar to the author.

And thus, a fact of some considerable importance is established—that, by due care and attention to the after management of a limb, the knee-joint of which has been removed, a most excellent result may be obtained independently of the use of any special apparatus.

17. Dr. Cotton's three cases.

Operated on.	Cured.	Died.
3	2	1

The first case, a boy æt. 9½ years, who had suffered from carious destruction of the knee-joint for three years, was operated on October 5th, 1853, and made a good recovery. I mention the dates of this case because it is one which exercises considerable influence over the expression which has of late been too frequently employed—viz., that the limb after excision, provided bony union has not taken place, is useless, or nearly so. In this instance there existed fibrous material between the ends of the two bones which admitted a considerable power of flexion. So interesting is this case that I shall give the results of the case in other words. On July 26th—"The boy has occasionally presented himself at the hospital up to this time. He attends regularly at the village school, a distance from home. He walks firmly and with tolerable speed, though with a stooping gait, which he is trying to correct, and which he thinks is owing to his having been obliged to sit so long a time at the hospital. There exists considerable power of flexion at the knee. The limb is equally developed with its fellow, and he is able to project it forwards or backwards with ease."

I shall, hereafter, adduce various reasons as to why the junction between the cut ends of the bones should differ, and shall, therefore, only add that in this case the union by false joint was dependent, firstly, on the nature of the cancellous structure of one or both bones; and, secondly, on the constant motion which was allowed to take place in this structure before adequate consolidation had resulted. For the reporter of the case adds:—"He was directed not to amuse himself so frequently with flexing the knee upon the splint, to which habit attention had been directed."

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* These drawings are omitted.—H. S.

The second instance in which Dr. Cotton performed this operation was on a female æt. 45 years, who subsequently made a good recovery; but the bones were knit together by an apparently fibro-cartilaginous junction.

The third case unfortunately ended fatally; the patient, a girl æt. 16, dying of anæmia, the ninth week after operation. Great disturbance had resulted after the limb was placed on a splint.

18. Mr. Gore's three cases.

Operated on.	Cured.
3	3

Possessing no very clear histories of these cases, I wrote to Mr. Gore, who very kindly replied to my inquiries, but regretted that he had no "special" notes of these cases. All the cases, children under fifteen years of age, did well. In two instances fibrous anchylosis was the immediate result, and in the other osseous union seemed to take place without the prior formation of a fibrous or semi-elastic tissue.

18½. Mr. Crompton's three cases.

Operated on.	Cured.
3	3

In the *Medical Times and Gazette* of 1859, are published two successful cases of Mr. Crompton, of Birmingham. The patients were exactly twenty-two years of age, and both made excellent recoveries. In one, a female, "tolerably firm union had taken place in three months," and "the other patient walked three miles four months after the operation, although sinuses still remained open."

Regarding the third successful case, Mr. Crompton was kind enough to write me, on March 29th—"That since I published two very successful cases of excision of the knee, a few months ago, in the *Medical Times and Gazette*, I have one unpublished. . . . I hear the patient has still unhealed sinuses, though the union of the bones was perfect when he left Birmingham." This case subsequently died, and Photograph No. 5, Illustration 21, copied from a drawing given by Mr. Pemberton, well illustrates the excellent anchylosis which knit, in an osseous bond, the two extremities together.*

19. Mr. Hancock's three cases.

Operated on.	Cured.
3	3

Regarding these three cases (which include all the operations of excision of the knee-joint which have been performed by this surgeon) Mr. Hancock writes to me, February 12th, 1859:—

"MY DEAR MR. PRICE,—I have excised the knee in three cases, and they all did well. In one there was very slight discharge when it left the hospital, but it was able to walk about. The other two were complete cures, and have much improved in health since the operations, which were performed, one above two, the other about a year since.

"Yours very truly,
"HENRY HANCOCK."

Since the receipt of this letter I have had the opportunity of seeing one of the patients last operated on—Charles Castle, æt. 24. The knee-joint was excised in January 1859, for disease which had existed for seven years. The patient, a strong subject, finds his limb, which, by the way, is only 1¾ inches shorter than its fellow, a most useful member. It is firmly anchylosed, and he can walk for a long distance without fatigue. It is a most satisfactory case, and Photograph No. 1, Illustration 23, well shows the admirable limb the patient retains.*

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* This drawing has been omitted.—H. S.

Since the above notes were taken, I find that this patient has been re-admitted into the hospital, and that Mr. Hancock having found that one or two sinuses led down to bare bone, extended the track of one of these channels, and by means of a chisel and mallet removed from the posterior surface of the joint some carious bone. The case has done well. The bones were found by the finger in excellent apposition. This secondary operation I particularly mention, because I have myself resorted to it on more than one occasion after having removed the knee-joint; and, also, because it shows that although sinuses, even leading to dead bone, may remain open without interfering, as some have denied, in a direct way with the utility of the limb as a means of progression.

20. Dr. Keith's three cases.

Operated on.	Cured.	Amputated.	Recovered.
3	2	1	1

Although these cases have been briefly recorded in one or more of the medical journals, I think it best to record their histories, as given to me in a letter from Dr. Keith, the operator.

This eminent surgeon writes as follows:—"I have pleasure in replying to your favour of the 16th May anent resection of the knee-joint. In the two cases you refer to,† and which were most successful, the disease commenced in the synovial membrane, and after many months of much suffering had resulted in denudation of the articular surfaces of cartilage-abscess in the joint and fistulous openings, but so superficially was the bone involved that my slices of the tibia, say one-third of an inch—of the femur three-fourths, and of the patella a mere paring—exposed healthy bone tissue, and so anchylosis progressed, and eventually the cure was complete."

The following history of the third case in which the operation was performed, is, however, the most interesting; and I therefore give it word for word, as sent me by Dr. Keith.

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* This drawing has been omitted.—H. S.

† These cases were operated on, one in November 1853, the other in May 1854. One of the patients was nine years of age, the other fourteen years.

"I. T., a seaman, æt. 33, eleven months ill with knee, much and uniformly enlarged, deep pain, broken rest, emaciated, no syphilis, but struma. Manifestly a scrofulous abscess on the outer aspect of the head of the tibia. Pulse never under 100. Excision performed on 10th March, 1855: a quarter of an inch taken off the femur, and half an inch off the tibia. These bones were expanded, interior reddish, and every cell filled with a lardaceous deposit. On sawing through the head of the tibia, an abscess in the very centre of that bone was opened, from which a teaspoonful of ripe pus escaped, leaving a thimble-shaped cavity. Three abscesses existed outside, and around the joint were also laid open by the incisions used by me," &c. . . . "Well, this case got every care that skill could devise. I was dresser myself, and fought on for 222 days; and at last, to save his life, gave in, and amputated the thigh, October 26, 1855, and on the 30th of November he was dismissed cured; and at this date commands a trading brig out of the port of Aberdeen, walking on an artificial limb. The joint, now in my possession, shows the tibia and femur both hollowed out by continued abscess and degeneration of the cancellous structure of both bones, with numerous cloacæ through their walls giving vent to pus, causing the many abscesses which I had had to open. All this was attended with sweating and looseness of the bowels, which could always be restrained by tannin, in ten-grain doses every four hours, &c. All, however, ended so well as to save the surgeon's credit and the patient's life; but the lesson is loud and telling. Resection is not for disease of the knee-joint, where the affection commences in the cancellous structure of the bones entering into the formation of that joint.

"Reason told me so before I operated; but I tried it. I thought an open joint, with the free discharge and irritation lessened—that good keep, and other suitable treatment, might remedy even the disease of the bones; but—no, no."

I have quoted this case in full, as it well illustrates the inappropriate application, as will presently be pointed out, of excision of the knee-joint for diffuse strumous infiltration of the articular ends of the long bones forming the knee.

21. Mr. Partridge's three cases.

Operated on.	Cured.
3	3

Since the year 1855 Mr. Partridge has excised the knee-joint three times, and with each of these cases I have a personal acquaintance. I have been enabled to follow out the history of one case during a period of three years. It is that of a lad æt. 17, at the time of the operation, which was performed May 23rd, 1857, on account of chronic disease of the knee. Two years and a half after he left the hospital I measured the limb, and found that it was three inches and a half shorter than its fellow (about two inches and a half of bone had been removed), and the lad was enabled to fulfil an arduous calling, which necessitated a great amount of walking. There was a slight amount of bowing outwards, or bending of the entire limb (for the junction of the femur and tibia had now converted the lower extremity into one member), but the leg was stout and well nourished.

At the early part of this month (December) I again measured the limb, and found that the shortening had increased an inch, and that the curvature at the *new* knee, or the line of junction of the two long bones, had likewise become more apparent. He is at present in the hospital, and under treatment the straight position of the limb is being regained.

Drawing No. 2, Illustration 24, made for me by Mr. Clarke, the dresser of the case, but which, I must admit, only shows but very imperfectly the various features to which I have alluded.*

22. Mr. Square's three cases.

Operated on.	Cured.	Amputated.	Recovered.
3	2	1	1

For the history of these three cases I stand indebted to Mr. Square.

* This drawing has been omitted.—H. S.

The first case, that of a boy æt. 11, delicate and strumous looking, had his knee-joint excised August 25th, 1857; and it is chiefly interesting because in the space of eight or nine weeks a portion—"a slice"—of the lower end of the femur exfoliated, and had to be removed. Somewhat later (Dec. 22nd), the ends of both bones were found so necrosed that it was deemed advisable to remove the limb by amputation through the thigh: this was accomplished on January 1st, 1856, and the patient recovered with a good stump. The second case operated on was one in every way successful, and forms the sketch forwarded to me by Mr. Square, taken some months after operation.* The patient seems to experience all the advantages which a limb *minus* the knee-joint can afford. The third was operated on in September 1860; and when last I heard of it, everything had progressed favourably.

23. Mr. Bickersteth's two cases.

Operated on.	Cured.	Termination unknown.
2	1	1

As far as I am aware, there is nothing very interesting to record of these cases, and, therefore, I shall at once pass on to the consideration of

24. Mr. Brotherstone's two cases.

Operated on.	Cured.
2	2

For the details of these two cases I am indebted to Mr. Brotherstone, who in a letter dated Alloa, Dec. 20th, 1858, describes at length the successful results of his two operations, which were both on children under twelve years of age. In each an admirable limb resulted, and the two children may be seen every day in the streets of Alloa walking with but slight impediment. Regarding the last of these two cases, it has been reported from one journal to another, and so on, that the child was "in the course of six or seven weeks after the operation enabled to walk." "It was, however," Mr.

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* I regret I have mislaid this sketch.

Brotherstone says, "as many months before he could move about quietly." I am, however, in possession of no very satisfactory evidence as to the development of the limb in either of these cases, which were performed in the year 1854; although in 1858, four years afterwards, the shortening was not increasing.

25. Mr. Cadge's two cases, including two cases which were performed at the Norwich Hospital.

MR. CADGE'S CASES.

Operated on.	Amputated.	Recovered.	Died.
2	2	1	1

CASES IN THE NORWICH HOSPITAL.

Operated on.	Cured.	Amputated.	Recovered.
2	1	1	1

Several of the facts most interesting in Mr. Cadge's cases have never been made public; while, even a notice of the two which are included under the head of "hospital" cases have not yet, as far as I am aware, been published. I shall, therefore, quote Mr. Cadge's letter to me regarding these four instances in which the operation was adopted. Mr. Cadge writes:—"My experience of resection of the knee-joint is very limited and very unfortunate.

"Two cases, both of which were failures. In one, a lad, the disease was chiefly of the synovial membrane, and secondarily of the cartilages. The boy's friends would not permit amputation, and in resecting the joint I trusted to the youth of the patient, to the free removal of all the pulpy material that was visible, besides removing the ends of the bones. The cases promised well for a time; gradually, however, the knee enlarged, the lines of incision re-opened, discharge became profuse, and thus health failed. At length I was allowed to amputate, but the patient died.

"The second case, a man about forty-five years of age, was a promising case: there was less pure synovial disease and more of destruction of cartilage. At the time of the operation I found a burrowing abscess, extending down the leg, close behind the tibia; and from this I foreboded evil. This case also did well for some time; the incisions healed almost entirely, and only so much discharge escaped as seemed proper, from what remained of the sac of the abscess; in about a month, however, the knee enlarged, the lines of incision stretched and presently gave way, the health deteriorated, and amputation was done. The patient recovered.

" Besides these, there have been two others in the hospital (Norwich): one followed by amputation and recovery; the other, a lad, with a very moderate amount of disease, made a good and lasting recovery. My impression is," continues this practical surgeon, " that some discrimination and care are required in selecting the cases for resection,—that it will generally be found useless to remove the ends of the bones when the synovial membrane is the primary and chief seat of disease, but that it is preferable to amputation in most other cases. I have frequently, I may say generally, opened the joint and examined its condition before deciding to amputate; but my present feeling would lead me to the old method, in all cases in which there is either much synovial thickening, or burrowing abscess, outside the joint.—(Norwich, August 9, 1860.)"

26. Mr. Canton's two cases.

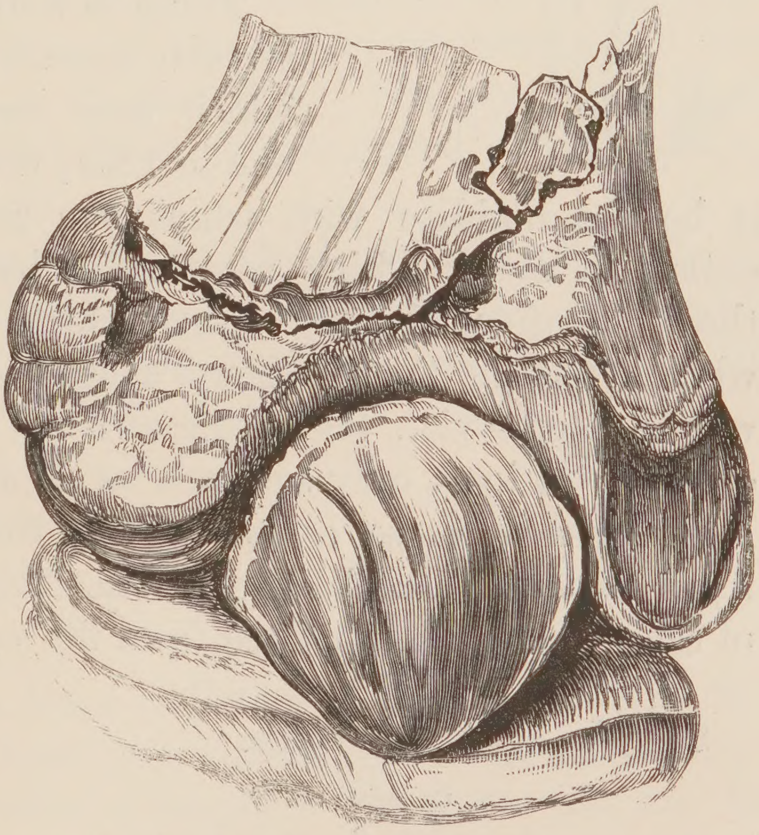
Operated on.	Cured.	Amputated.	Recovered.
2	1	1	1

Among the most interesting of all the cases which I have to submit, those of Mr. Canton stand foremost. While all the cases recorded in these pages were undertaken on account of disease or deformity, these two were for accident.

The first is that of a boy, æt. 8 years, who, falling from a cart, forcibly separated the shaft of the femur from its epiphysis. For some days it was supposed that union might ensue, as every available form of mechanical ingenuity was put in practice to keep the parts quiet and in apposition, but to no purpose; suppuration took place, and Mr. Canton, finding bad symptoms progressing, wisely resorted to excision of the implicated parts. This was accomplished, and the lad rapidly recovered. He left the hospital, but on his return home, his parents finding that the limb hung as " a flail,"—for a weak, inefficient fibrous union tied the bones together,—requested that the limb might be amputated. I had the advantage of seeing this case, and regretted the performance of amputation. A good recovery was made. Drawing No. 1, Illustration No. 15, shows the exact size of the portions which were removed, also the nature of the fracture through the femur. Another accompanying sketch* shows the ends of the femur and tibia bound together, although at some distance apart, by good, firm, fibrous material.†

The other case was in many respects similar, and is detailed in the *Pathological Transactions.*‡ In this instance the patient was æt. 15, and was knocked down by a horse October 21st, 1859. Inflammation of the joint succeeded, although due care was exerted to obtain union of the portions. High constitutional symptoms setting in, Mr. Canton excised the joint on November 3rd, 1859.

The exact drawing (see woodcut annexed) shows more correctly than my pen will do the nature of the injury. A most admirable cure resulted, as will be seen by reference to the beautiful photograph (see woodcut in the next page) of the boy taken a year after the performance of excision, and presented to me by Mr. Canton.



These two cases are so rare, the nature of the injury having only occasionally been noticed, that I give reference to some few cases which may be found scattered through surgical literature.

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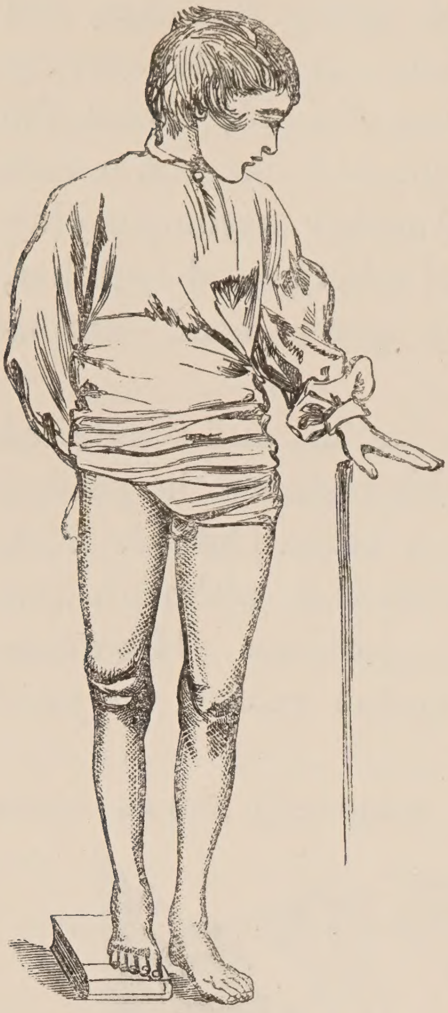
* These drawings furnished by the author have been omitted.—H. S.

† *Lancet*, August 28, 1858.

‡ Pathological Trans. for 1860.



Sir C. Bell gives two instances in his work on "Injuries to the Spine and Thigh Bone," London, 1824. M. Curral (Archives Générales de Méd., tome ix., 3^{me} série. Paris, 1825) likewise refers to the accident; while Liston and Mr. Adams, of Dublin, likewise mention the accident: the first authority, in his "Elements of Surgery," 2nd edition, p. 721, London, 1840; and the latter, in article "Abnormal Conditions of Knee-joint," vol. iii. *Cyclopædia of Anatomy and Physiology.*

27. Mr. Le Gros Clarke's two cases.

Operated on.	Cured.
2	2

There is nothing of any special interest to remark about these two cases, which were submitted to operation, one in 1857, the other in 1859, except it be the rapidity with which the first recovered, and the extent of union which resulted in less than a month. In these operations the proceeding which I have before noticed, when referring to Mr. South's cases in the same hospital, was adopted—viz., the taking away of a very limited amount of bone; indeed, only so much as is absolutely necessitated. References to these cases may be found in the *Lancet* for April 2nd, 1857, and August 4th, 1860, but the particulars of each I have also received from the operator himself.

28. Mr. Coe's two cases.

Operated on.	Cured.
2	2

These two cases are so admirably and fully reported by Mr. Butcher, that I have not thought it necessary to obtain any further information from the operator regarding them. The patients were children, and both recovered with useful limbs. The operations were performed in 1856. It is, however, worthy of notice, that in each instance considerable disease of bone existed with the joint mischief, and rendered the operations more serious, and influenced, as will be seen, the character of the reparation. Further remarks on these cases I shall reserve till treating of the growth of a limb, after removal of the knee-joint.

30. Mr. A. M. Edwards' two cases.

Operated on.	Cured.
2	2

These two cases were operated on in the year 1857,—the one for deformity, the other on account of disease. The age of the patient who underwent excision of the knee-joint for deformity was twenty-three years. A reference to Drawing No. 3, Illustration 28,* shows the nature of the deformity, which consisted in the leg being flexed acutely on to the thigh, the head of the tibia displaced into the popliteal space, and the condyles of the femur projecting for three inches beyond the top of the tibia. The portions forming the vitiated and altered joint were removed, and the patient made a good recovery.

The other case was that of a child, æt. 5 years, who had had disease of the knee-joint for three years. He made a quick recovery, and in twelve months could run about with ease.†

31. Mr. Gant's two cases.

Operated on.	Cured.	Amputated.	Recovered.
2	1	1	1

These cases have been published;‡ but as I have since obtained some additional information regarding one of them, I shall state it somewhat at length. The first case was that of a woman who for years had suffered from chronic disease of the knee-joint. In all respects it was an admirable case for excision, which operation was adopted, and in a few months the woman had a most useful limb. Through the kindness of Mr. Gant, I am enabled to offer the sketch of the limbs, both before and after operation. It will be seen by referring to the Drawing No. 1, Illustration 25,* that the limb from which the knee-joint was removed is now a most useful member.

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* This drawing has been omitted.—H. S.

† *Lancet*, April 24, 1858.

‡ *Lancet*, August 4, 1860.

The second case is one of still greater interest. The patient, a young man, had undergone excision of the knee-joint at the commencement of the present year, on account of chronic mischief of the articulation. The recovery from the operation was slow, but when he left the hospital the limb was in a most excellent position, and anchylosis had considerably advanced. He was sent to Margate, and remained there some time; during this period various abscesses formed in connection with the ends of the bones, extending down the leg for some way: the constant discharge from these abscesses greatly weakened his health. At the commencement of August 1860, he was admitted into St. George's Hospital, under the care of Mr. Hawkins, who, judging that the limb was too far diseased to allow of its being saved, amputated through the thigh, on August 16th. I had the opportunity of seeing the operation and examining the limb after removal: abscesses were seen running in various directions, and penetrating down to the bone. Sinuses existed near the junction of the tibia and femur, which led to one or two spots of rough and carious bone. The anchylosis which united the two bony surfaces was of a mixed character, but very firm. The bones were in admirable apposition.

The parts about the junction between the two bones have been carefully dissected by Mr. Holmes, who has kindly permitted me to have a drawing made of the preparation, which I hold to be a very valuable one, as illustrating several features of considerable interest, to be hereafter more particularly dwelt upon. (*Vide* woodcut in the next page.)

32. Newcastle Infirmary, four cases (including one case

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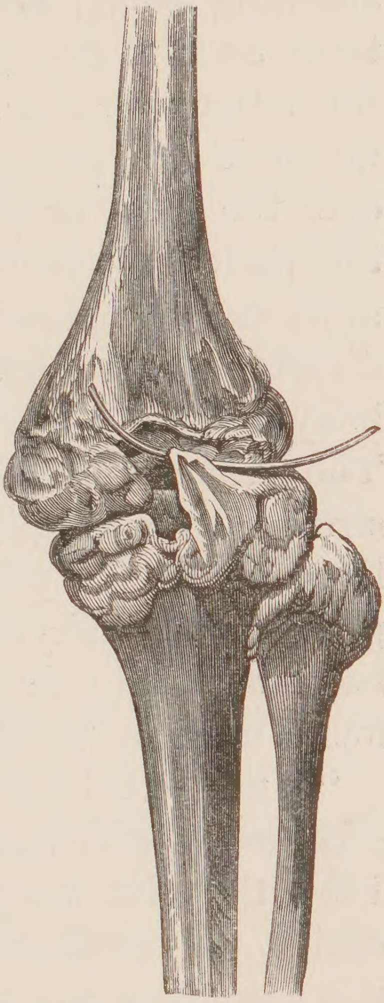
* This drawing has been omitted.—H. S.

by Mr. Heath, two cases by Mr. T. Greenhow, and one under the care of Sir J. Fife).

Operated on.	Cured.	Amputated.	Recovered.
4	1	3	3

Looking at the above table, the admirer of excision of the knee-joint is somewhat surprised to see, that out of four cases of the operation, only one case has succeeded, while three have subsequently been submitted to amputation.



The former case only has been published :* it is that of Mr. Heath, a lad, æt. 14 years; he was operated on in 1854, and made a most excellent recovery. Through the kindness of Mr. Bolton, the house surgeon, and who had the management of the case, I am able to offer a fac-simile of the limb (*vide* Photograph No. 3, Illustration 23) ;† and to quote the following, written to me by the same gentleman, on August 23, 1860 :—" Mr. Heath's patient called on me a few months ago; he was able to walk steadily, with the aid of a stick, and was about to embark for Australia."

This case is also interesting, because the mechanical treatment was conducted in a way somewhat different to the usual plan. Photograph No. 4, Illustration 20, shows the limb in position, and the splint on which it was treated.

Satisfactory as this case is, it is the more so in comparison with the three now to be considered. An eye-witness of these cases in their various stages, writes to me the latter part of this year, and says :—" The other cases (these three) were unsuccessful, and my impression is, that in each the after-treatment was by no means calculated to ensure any better success,—a clumsy, flat leather splint with the first case, the McIntyre in the others, with too frequent shiftings, being used to support and steady the limb."

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* Patholog. Trans., Newcastle, 1858.

† This and the next drawing have been omitted.—H. S.

The first case, æt. 31, was submitted to excision, June 14, 1853. A *chain saw* was used to cut the bones. In the treatment, dislocation backwards of the tibia took place; then alarming hectic, so that amputation of the limb was necessitated on 27th September, 1853. The patient recovered from this latter operation. The dissection of the joint after amputation is interesting:—" Two sinuses exist laterally, and also over the head of the fibula communicating with the joint, or the parts representing it. On dissecting the integuments upwards, the ligamentum patellæ was found reunited; and on dividing this a thick layer of organized lymph, and in places bony deposit, showed that an attempt at union had been made. The surface of bone elsewhere looked healthy. The cancellous structure was occupied by healthy granulations. The posterior ligament of the joint appeared in a pulpy condition. The patella was anchylosed to the femur. The sinuses passed backwards into the popliteal space, where the vessels were found more or less disorganized."

" The second case which required amputation, was that of a lad æt. 8, who was greatly emaciated. On November 29th, 1853, the joint was excised; purulent fluid occupied the joint cavity, the cartilages were ulcerated, and the bones soft. In this case there was no attempt at anchylosis; the suppuration was profuse, and after a few weeks he was removed from the hospital to his home, where the limb was amputated by the Union surgeon."

The third case in which amputation was performed after removal of the joint, was in the case of a boy æt. 7, a highly scrofulous lad, who had for some time suffered from " scrofulous disease of the articulation." The resection was performed February 23rd, 1858. Suppuration of a severe kind subsequently, however, set in, the pus burrowing and finding exit through sinuses in various parts, and ultimately necessitating amputation, which was resorted to in the September following.

33. Regarding Mr. Hey's two cases I have nothing particular to say, except in both instances the usual amount of expected reparation did not take place till a more protracted period than is generally necessitated. The operations were performed in the year 1856.

34. Mr. Hoffmann's (of Margate) two cases.

Operated on.	Died.
2	2

Neither of these cases has ever been published, but I had the opportunity of seeing both, and recommended the operation in the first, a girl about eighteen years of age. Unfortunately this operation, performed on account of chronic disease of the joint, proved fatal in a few days; and I believe I am stating not only my own conviction, but the correct conclusion, that mechanical irritation of the cut ends of the bones induced such an amount of inflammatory mischief, in both of the bones and periosteum, that death was thereby the consequence.

In the second case, a man operated on in 1860, on account of synovial disease, associated with stripping off of the cartilages, died some days after the operation. I saw this patient within two days of the removal of the joint, and his death; and it appeared to me that he was dying of irritation, hectic, &c.

35. Professor Pirrie's two cases.

Operated on.	Amputated.	Cured.
2	2	2

Mr. Pirrie, writing to me regarding these two cases, says, that he can give no further information beyond that already published by Mr. Butcher in 1856.

The unfortunate histories of these cases show that the most conservative intentions of the surgeon are often rendered abortive by reason of various infections, &c., which sweep through a hospital ward. Both these cases suffered from unforeseen and dangerous maladies. In one, a child æt. 10, operated on May 17, 1854, amputation was necessitated at the end of three weeks on account of suppurative fever and hectic, induced by an attack of measles. The second case, also that of a child æt. 14, operated on November 4th, 1854, was, nine days after excision of the knee-joint, subjected to amputation of the thigh by reason of an attack of erysipelas, which was then prevalent in the hospital.

36. Mr. Quain's two cases.*

Operated on.	Died.	Amputated.	Recovered.
2	1	1	1

The first case attracts some attention, not only from the fact that death took place on the thirteenth day, but because it was deemed advisable to place a seton between the outer hamstring muscle and the popliteal vessels. Delirium was, in all probability, the cause of the death of this patient, a fine young man, æt. 26. The operation was performed October 9th, 1856.

The second case was given to me by the house surgeon who attended to it. The patient was a boy, and for some years he had disease of the knee-articulation. During the course of a reasonable period no union between the cut extremities of the bones took place, so that Mr. Quain deemed it expedient to remove the limb. He did so, and the patient made a good recovery.

37. Concerning the late Mr. Statham's two cases I have little or nothing to say, except that they were both cured.

38. Mr. Sympson's two cases.

Operated on.	Cured.	Died.
2	1	1

Mr. Sympson has kindly forwarded me some information regarding these two cases, which, although meagre, is confirmatory of them. The first, a girl, was operated on in 1858, on account of synovial disease and ulceration of the condyles of the femur. She was cured in three months, although osseous union was not completed. The head of the tibia was not touched during the operation, and it took two years for the limb to become quite stiff.

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* Mr. Quain, who has happened to read this paper as a Member of Council of the College of Surgeons, wishes to state that the reference to him is incorrect as to the circumstances stated and the number of the cases.

Mr. Sympson, in a second letter, dated Lincoln, August 22, 1860, writes:—"I have seen the clergyman of the parish (in which the girl resides), who tells me that the limb seems perfectly stiff, and the girl gets about with the aid of a stick."

The second operation, performed in 1860, terminated fatally "in a few hours," but from what cause I am not exactly certain.

39. Mr. Thomas's (Manchester) two cases.

Operated on.	Cured.
2	2

Of these two cases I have nothing particular to write, but shall probably refer to them when treating of the development of the limb after excision of the knee-joint in young subjects. Both operations were attended with success, and were performed in 1853, in children of the respective ages of twelve and sixteen years.

40. Mr. Benfield's (Leicester) case.

Operated on.	Immediate Amputation.
1	1

This case is worthy of special notice, because excision of the joint was first performed, and the disease being found of a very extensive nature, amputation through the thigh was *immediately* adopted; and the patient, a girl, æt. 16, made a rapid recovery, the *circular* wound of the amputation healing "almost by first intention."

In two other instances, one under the care of Mr. Fergusson, the other under Mr. Hutchinson's care, was a similar operation resorted to, the disease being too great to admit of the hope of excision being a satisfactory proceeding. In one amputation was followed by death, in the other by a cure.

Mr. Benfield remarks on his own case:—"I attribute the want of success to resection as dependent on having delayed the operation too long, but there was no such improvement under treatment as to lead me to hope for anchylosis."—*Letter*, *op. cit.*

41. The following three cases of excision of the knee, demanding subsequent resort to amputation, I shall briefly notice under one head, because there seems no doubt whatever that the removal of the limb, after excision of the articulation, was necessitated by the inappropriate treatment which the limb received.

Operator.	Amputation.	Result.
1. Mr. Birkett.	Yes.	Recovered.
2. Mr. Stanley.	Yes.	Recovered.
3. Mr. C. Forster.	Yes.	Recovered.

1st Case. Mr. Birkett excised the knee-joint of a man, æt. 34, for incurable disease, on May 29th, 1855. After the operation "the limb rested on a back splint, and sand-bags were placed at the sides to keep it steady." On the *third* day "the dressings had been changed, and a pillow and sand-bags substituted for the splint, which was thought to hurt him; but he could not do without the splint, which was again applied."* During the entire treatment, "however, it was extremely difficult to retain the ends of the bones in proper relation to each other, and the end of the tibia was drawn backwards behind that of the femur."†

Amputation was performed on the thirty-eighth day, and the man recovered, although repeated hæmorrhages, &c., protracted the cure.

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* Mr. Butcher's Second Memoir of Excision of the Knee-joint.

† *Lancet*, 1856.

2nd Case. On the 29th of March, 1856, Mr. Stanley excised the knee-joint of a girl, æt. 15. The soft and osseous structures of the articulation were found diseased.

"The patient was shifted every few days, and consequently never being firmly fixed, the flexor muscles gradually drew the leg behind the thigh, although the tendons did not appear tight; of course the original wound gaped and became very extensive."* The leg was amputated above the knee, to save life, on 10th of May, and she eventually recovered.

3rd Case. Mr. C. Forster excised the knee-joint of a lad for extensive disease in 1858, but owing to inappropriate treatment the tibia and femur were allowed to shift their positions, so that all control was lost over the limb, and amputation was necessitated *three weeks* after the first operation."†

Although these are three most prominent examples of indifferent after-treatment, so far as the maintenance of the bones in a proper position is concerned, yet I have met with other illustrations of the baneful effects from non-attendance to mechanical skill and treatment, in the management of cases of excision of this articulation.

42. As examples of good cures and the preservation of useful limbs after excision of the knee-joint, perhaps there are no two cases which I can point to, in the long list which are recorded in my tables, than those under the care of Mr. Burman and Mr. Tubbs, of Wisbeach. Both these gentlemen have not only favoured me with an account of their operations, but have forwarded me photographs of their patients, whose knee-joints were excised in 1856. Reference to these—Photographs Nos. 1 and 2, Illustration 28 ‡—will at once show, that although *four* years have elapsed since the operations, both patients enjoy most useful and well developed limbs.

With regard to Mr. Burman's case, Mr. B. says that "The limb is full two inches shorter than the other, and the bones are perfectly united."

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* *Lancet,* September 1856.

† *Medical Times and Gazette.*

‡ These drawings are omitted.—H. S.

In Mr. Tubbs' case perfect consolidation did not take place till two years after operation.

43. Mr. Cutler's case is interesting, because only the articular surface of the femur was removed in the operation. The patient, a boy, operated on in January 1856, did not, unfortunately, live long enough to enable an idea to be formed as to the nature of the union which would take place when only one articular surface of the joint is removed.*

44. Mr. Curling's single operation is worthy of consideration, because it exemplifies the necessity that may arise for amputation of the limb, some weeks or months after excision of the joint, by reason of caries of the ends of the bones complicated with abscesses of the soft parts. The operation of excision was performed June 21st, 1860; amputation through the thigh October 11th, 1860. The bones were found bound together by a thick band of condensed cellular tissue, nearly three inches in breadth, where it sprang from the tibia and spread from that bone to the femur. The upper part of the tibia was carious, and the cancellous structure of both bones diseased.†

45. The cases (one operated on by Mr. Lawson, and the other by Mr. C. Heath) were undertaken on account of deformity—permanent flexion of the tibia on to the thigh at a more or less acute angle. Both patients were lads, of the age of eight years.

Reference to Drawings Nos. 1 and 2, Illustration No. 27,‡ show the conditions of the limb in Mr. Lawson's cases, both before and after the operation, which consisted in a complete excision of the joint, which was not only deformed, but destroyed by chronic disease of long standing. I have had daily opportunities of seeing this case, and assisted at the operation, and I can truly say that I have never seen an instance in which the operation has been attended with more beneficial results, or followed by less constitutional disturbance. And here I may mention a feature which occasionally embarrasses the surgeon, and which very frequently occurs after excision of the knee-joint in young subjects. I allude to the tendency which always exists for the limb—now one limb from the hip to the ankle—to become *bowed* just where the junction between the tibia and femur has taken place. This bowing was particularly apparent in this case, for the child was allowed to run about ten weeks after the operation, and in the course of a month he was taken back to Mr. Lawson to have the position of the limb rectified. The reason of this *bowing* I shall hereafter state, as I have known it to occur in many instances after operation.

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* *Lancet*, vol. ii., 1856.

† *Medical Times and Gazette*, Nov. 17, 1860.

‡ These and the next drawings also are omitted.—H. S.

Drawing No. —, Illustration No. 10, picturesquely and faithfully represents the altered knee-joint removed by Mr. Heath. I had the advantage of seeing this patient; and as there was no doubt as to the propriety of excision, the operation was performed. The drawing shows the reparative action which nature had set up, and the difference of the two anchyloses which unite the femur to the tibia. The lad made a good recovery, but for several months the bond of union between the bones was flexible and yielding. Sinuses also existed which allowed the escape of a slight discharge. I mention this case particularly, as it shows that the operation of excision was undertaken, as it can often be with great advantage, to save a limb which is rendered useless by reason of permanent deformity at the joint, with co-existing disease.

46. In September 1860 Mr. Hulke excised the knee-joint of a woman under thirty years of age, on account of long standing disease, in which the bones were found implicated.

This case is only interesting in one point of view, because by referring to Drawing No. 1, Illustration 24,* which represents Mr. Hulke's patient lying in the position in which she remained some weeks after operation, it will be seen that the end of the femur is considerably in front of the upper and front surface of the tibia. I have carefully examined this patient, and I find that the slipping backward of the tibia has been gradual and partially unnoticed, on account of the swelling of the parts immediately concerned in the operation. It will be interesting to see, at some future period, what kind of junction unites the plane of the two bones. *Apropos* of this subject, I was, while lately in Prussia, shown by Professor Robert, of Coblentz, a cast of the anchylosis which resulted in one of M. Textor's cases, in which exactly the same displacement of the tibia had taken place. The anchylosis in this instance was completely bony, and the two bones were, as it were, welded together by osseous material.

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* This drawing has been omitted.—H. S.

47. A case of unusual interest, and unique in its kind, I believe (although Professor Roser, of Marburg, informs me that a similar example has occurred in his own practice), is the following:—On the 6th of December, 1859, Dr. King, of Hull, removed the knee-joint of a girl, æt. 16, on account of chronic disease of the joint and partial backward dislocation of the head of the tibia. The disease was of eight years' standing. The treatment, if we can judge from the report of the case,* was far from satisfactory, but the girl was dismissed from the hospital with a moderately improved limb, although there was no anchylosis, at least bony. After her discharge from the Hull Infirmary the *knee* became painful (I say the knee, because, as will be seen, a true false-joint had been formed) and sinuses began to form. In September 1860 she was admitted into King's College Hospital, under the care of Mr. Fergusson, who, failing to give the girl a useful limb by any mechanical contrivance, in November *resected* the ends of the bones, which were lying in the exact position represented by the *Cast* No. 7 (under glass case).†

A true false-joint had resulted. The ends of the tibia and femur, as seen, were greatly altered in shape, and were bound together by a firm tough substance, partly incorporated with the posterior ligament of the joint.

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* *Medical Times and Gazette*, April 14, 1860.

† This cast was sent in with the Essay.—H. S.

48. The admirable results of a case of excision of the knee-joint are practically exemplified in the following case, which Mr. Mayo, of Winchester, has kindly forwarded to me. It has never been published.

"David Curtis, æt. 15, was admitted into the Winchester Hospital, September 10th, 1856, with chronic disease of the knee, which was permanently flexed, and any attempt to straighten it gave considerable pain, but otherwise so little enlarged as to make it a matter of doubt whether the division of the hamstrings and forcible extension, under chloroform, would be a more suitable treatment than excision.

"However, as he was willing to submit to anything rather than to amputation, and as we were rather anxious to try the new operation, I performed excision of the joint, on the 25th of September, making the lateral incision and then a transverse one through the ligamentum patellæ, turning up the flap, dividing the lateral ligaments and hamstring tendons, and crucial ligaments, &c.

"The limb being unflexed, the cartilaginous surface of the condyles was found ulcerated, the semilunar cartilages thickened, and the head of the tibia eroded. About half an inch of the condyles was first sawn through, and then a similar portion from the tibia; but, as the sawn ends did not fit comfortably, a second slice was cut from the femur. The limb was placed on an iron splint, and everything went on well for some days.

"The dressings were not touched for some time. It will be needless for me to detail the continued toil which I endured in looking after the case, which must be familiar to you, in the dressings and adjusting the splints every two or three days, &c. Suffice it to say, that in two or three months he surprised us by volunteering to lift up his leg, so as to satisfy me as to the union between the tibia, femur, and patella. . . . . Abscesses formed some months after, which, when opened, soon healed. Lately he has been living about as a sort of cad, working in gardens, looking after cows and pigs, moving heavy loads in wheelbarrows, carrying large baskets of potatoes—in fact, using his limb in the roughest manner, contrary to everything I had enjoined him; getting tipsy with beer and spirits; lying about at nights, so that during the years 1858 and 1859 he made no complaints of his knee, and constantly affirmed it was quite as strong as the other, although it was manifest that the limb was considerably distorted inwards and the foot turned out."

Unfortunately this patient was re-admitted into the hospital, having caught cold, and died of erysipelas on the 15th of July, 1860.*

Mr. Mayo forwarded the anchylosed knee, or rather ends of the tibia and femur, to St. Bartholomew's Hospital Museum, and, by the kindness of Mr. Savory, I have the opportunity of presenting an exact fac-simile of the consolidated parts, as will be seen by referring to Illustration 13.† The bones are firmly and admirably welded together, not by bone, as might be imagined, but by tense, fibrous textures, which, however, is only demonstrated by forcibly manipulating with the preparation; showing that, even in the most favourable cures after excision, the junction is oftentimes for a very considerable period, if not permanently, of a non-osseous character.

49. Secondary hæmorrhage may, after excision of the knee-joint, prove of trouble to the surgeon and danger to the patient. This mishap is well illustrated in the cases of Mr. Windsor and Mr. Ure.

In Mr. Windsor's case: "About three hours after excision of the joint, hæmorrhage to so great an extent took place that he (the patient) became almost pulseless." The bleeding was stayed partly by the use of the actual cautery, and partly by lint dipped in spirits of turpentine.* Mr. Ure kindly allowed me to see his case, when greatly reduced by secondary hæmorrhage; the bleeding certainly was extensive, but was eventually controlled. Turpentine was likewise employed, but I cannot for one moment congratulate the operator upon his wisdom in using this highly irritative material, especially as the bleeding was, in a measure, from the open tissue of the bones.

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* I saw this patient whilst I was at Winchester in May 1860, and can testify to the great utility of the operated limb. Although it was much distorted, the young man could move it about famously.—H. S.

† This drawing has been omitted.—H. S.

50. No single case with which I am personally acquainted shows so plainly the deformity and arrest of development which is likely to ensue after excision of the knee-joint, as a case operated upon by Mr. Henry Smith, on October 18th, 1854. I was present at the operation, and am consequently well aware of the nature of the case. A good two inches of the bones were removed, and the patient, a child, æt. 6 years, made a rapid recovery with a limb in the straight position. The disease for which the operation was performed was that which is termed circumscribed strumous matter in the cancellous structure of the tibia. The gouge was freely used, and the patient recovered, but the junction between the bones was apparently fibrous, and continued so for many years. At this present time, December 1860, the limb presents the appearance as represented in Photograph No. —.† The leg is flexed nearly at a right angle with the thigh; the femur projects considerably forwards, and the lad is compelled to walk about on such an apparatus as is figured. The bones are not yet completely anchylosed, and I much doubt if ever osseous anchylosis will unite them.

This case shows the extreme susceptibility there exists for the head of the tibia to be drawn backwards and displaced when there is no adequate resistance to prevent or overcome the tension of the hamstring tendons—the resistance, of course, being the osseous and unyielding nature of the anchylosis.

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* *Medical Times and Gazette*, November 29, 1856.

† I very much regret that this photograph, which was on glass, has got broken, and that I am unable to replace it.

I think this case serves to explain how it was that the rectangular anchylosis obtained in Sir Philip Crampton's case of excision (that of Anne Lynch).*

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* I am sorry to say I have lost sight of this patient for several years. I may, however, state that during the time I had opportunity to watch him (and this was some years after the operation), his limb, although distorted, was remarkably useful to him.—H. S.

SKETCH OF THE HISTORY OF THE OPERATION OF EXCISION OF THE KNEE-JOINT AS PERFORMED IN AMERICA.

Although the operation of excision of the knee-joint has been so frequently performed in Great Britain, on account of disease, accident, and deformity, yet American surgeons have failed to lend it that encouragement which undoubtedly it deserves.

Not only on searching through the medical (American) journals have I failed to find frequent allusions to cases of excision of this special joint, but on direct application to many authorities on Transatlantic surgery, I am unable to obtain any great amount of information regarding it.

On March 7th, 1859, I received the following letter from Mr. Mason Warren, the eminent surgeon of Boston, United States, enclosing an account of two of his cases. (Extract):—"My case, which I lately performed, has perfectly recovered, and from the shape of the incision he has now a handsome-looking joint (?) Dr. Cabet's case is the only other one which has been done in Boston. Dr. Buck, of New York, and Dr. Brainard, of Chicago, are the only other cases I know of."

Altogether, as the following table will show, I have only been enabled to collect the meagre number of six cases, and the histories of these somewhat imperfectly.

No. of Cases.	Operator.	Nature of Affection, "Disease."	Deformity.	Not mentioned.	Cured.	Not mentioned.
1.	Mr. Warren ..	..	1	..	1	..
2.	Mr. Warren ..	1	..	..	1	..
3.	Dr. Buck	..	1	..	1	..
4.	Dr. Kinlock ..	1	..	..	1	..
5.	Dr. Brainard ..	..	..	1	..	1
6.	Dr. Pancoast ..	..	..	1	..	1

I have already referred to Dr. Warren's own account of his cases, which may, moreover, be found detailed more at length in the *Boston Medical and Surgical Journal* for December 23rd, 1858. In the first case, that of a man, æt. 32, bony anchylosis resulted in two months. The operation was undertaken on account of chronic disease of the articulation. In the second case, a fall, with subsequent inflammatory mischief, necessitated the operation. Dr. Gordon Buck's case of excision was undertaken on account of deformity of the joint following disease. The patient was a man, and the operation was performed August 9th, 1853. The leg was flexed at an angle of 135 degrees to the thigh, and the head of the tibia was displaced outwards. The mischief resulted from a gunshot wound.

There is a feature in this operation worth recording. The cut ends of the femur and tibia were kept in apposition by means of iron wire sutures. A cure resulted, anchylosis obtained, but the limb was one inch and a half shorter than its fellow.*

Dr. Kinlock, surgeon to Roper Hospital, Charleston, records a very interesting case.† It is that of a woman, æt. 58 years, whose knee-joint he excised in 1856. Fibrous union existed for some time, but eventually (in three years) osseous consolidation took place, and she could walk with ease.

With the histories of Drs. Pancoast and Brainard's cases I am not familiar, for I fail to find any mention of them, even in the latest publications of American authors.‡

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* American Journal of Medical Sciences, vol. xxvii. p. 550.

† Ibid., vol. xxxviii. p. 70.

‡ Dr. Grant, of Ottawa, has recently forwarded to Mr. Fergusson the photograph of a patient on whom he successfully performed the operation, Nov. 2, 1864. The illustration, which is in my possession, shows an excellent and well-shaped member. The operation has also been recently performed in Montreal.—H. S.

SKETCH OF THE HISTORY OF THE OPERATION OF EXCISION OF THE KNEE-JOINT AS PERFORMED ON THE CONTINENT, FROM 1850 TO 1860 (INCLUSIVE).

I have already observed that one of the most distinguished French surgeons, M. Velpeau, in a letter to me, dated 1859, not only discountenances the operation, but speaks of it in terms by no means encouraging to those who would attempt its introduction into French surgery.

M. Guérin also, in a late work on Practical Surgery, speaks of excision of the knee-joint as an operation that cannot be performed with any degree of safety. In short, the condemnation into which the proceeding fell by the signal failure which attended Roux's single operation has remained.

M. Giraldes has, however, by placing the stubborn yet, it would appear, unconvincing proofs of the success of the operation as performed in England, before the French Academy, endeavoured to induce a practical consideration of it. Dr. Lefort has also lately written a thesis on the subject; and M. Ollier, of Lyons, has informed me that he fully intends to give the operation an extended trial.*

In Germany, however, several surgeons have been busy testing the merits of the proceeding; and although I am unable to offer *all* positive statistics relating to its adoption, still I can append the following, the correctness of which I can vouch for.

NOTE.—I much regret that I cannot here give the statistics of a few operations which have been, I know, performed by Professor Langenbeck, Textor, jun., and one or two other surgeons. While lately in Germany, I was not sufficiently fortunate to obtain promised statistics, and the accounts I possess of some operations are too inaccurate to record.

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* M. Gayet, surgeon to the Hôtel Dieu at Lyons, has recently performed this operation successfully. I doubt not that the prejudices entertained against it will as surely be dispelled in France as they have been in England. —H. S.

TABLE OF FIFTEEN CASES OF EXCISION OF THE KNEE-JOINT OPERATED ON BY DR. HEUSSER, OF HOMBRECHTIKON (CANTON ZURICH).

REVIEW OF THE RESECTIONS PERFORMED BY DR. F. HEUSSER IN HOMBRECHTIKON (CANTON ZURICH).

No.	Name.	Dwelling.	Age.	Year and Day of Operation.	Disease.	Constitution.	Duration of Disease.	Result.	Length of Time.	Specific Result.	Portions Removed.	REMARKS.
1	Johannes Frei, tailor	Bubikon, Canton Zurich	20	1848, July 18th	White swelling	Scrofulous	5 years	Cured	18 weeks	Complete osseous union	Lower end of the femur, upper end of the tibia, and fibula	In the 18th week after the operation the patient could be placed upright. Had an attack of typhus in the 20th week, which kept him in bed six weeks. Convalescence; marked constitutional improvement. In the 40th week perfect use of the extremity, without any artificial support. At present in good health; works ten to twelve hours daily.
2	Jacob Bossut, weaver	Hombrechtikon, Canton Zurich	32	1849, Jan. 20th	Ulcer of the medullary tissue	Tubercular	4 years	Cured	26 weeks	Artificial joint	Lower end of the femur; the upper part of the tibia and fibula were cleared	The patient could walk without the assistance of a support, but died of tuberculosis two years subsequent to the operation.
3	Caspar, tailor	Wezikon, Canton Zurich	6	1849, April 23rd	White swelling, local cause	Hectic	3 years	Cured	7 weeks	Complete osseous union	Both condyles of the femur, the upper end of tibia, and fibula	In the 12th week after the operation all supports were abandoned.

4	Bernard Oppenfuss, artisan	Albisreider, Canton Zurich	26	1850, July 17th	White swelling, local cause	Hectic	5 years	Cured	20 weeks	Complete osseous union	Both condyles of the femur, upper ends of tibia, and fibula	The patient was discharged in the 20th week, but a fistula remained for several years; now quite healed. Walks whole day without difficulty. Three weeks after the operation there was secondary hæmorrhage, which yielded to pressure and the application of the tourniquet.
5	Regula Diener, weaver	Hombrechtikon, Canton Zurich	24	1850, Aug. 5th	White swelling	Tubercular	4 years	Death	35 weeks	No union whatever	Both condyles of the femur, and upper end of the tibia and fibula	During the first ten weeks after the operation the parts appeared inclined to unite. Numerous tetanic attacks prevented the use of proper apparatus, and the tuberculosis appearing with renewed vigour soon put an end to her life.
6	Anna Staker, needlewoman	Freienbach, Canton Schwyz	18	1850, Aug. 23rd	White swelling	Tubercular	9 years	Death	41 weeks	Fibrous union	Condyles of the femur, and upper end of tibia and fibula	Matters progressed favourably till the 14th week, but the patient was very debilitated when the treatment was commenced, and on that account there was no firm anchylosis. The limb was useless; at a later period it was amputated, when death ensued in four days.
7	Christian Herrman, carpenter and hunter	Ebnat, Canton St. Gallen	42	1851, July 27th	Bony anchylosis; thigh so bent that toes of diseased limb scarcely touched upper part of calf of sound leg. Shortening, 18″ p.m. Cause, a wound of the joint	Good	10 years	Cured	8 weeks; nearly by first intention	Complete osseous union	Various parts of the anchylosis by a wedge-shaped piece, till the contraction was removed	Nine months after the operation the patient made a mountain tour with me over a mountain 6,500 feet high, across the steepest precipices. He now annually provides me with venison and Alpine birds of his own shooting.

TABLE OF FIFTEEN CASES OF EXCISION OF THE KNEE-JOINT.—(*Continued.*)

No.	Name.	Dwelling.	Age.	Year and Day of Operation.	Disease.	Constitution.	Duration of Disease.	Result.	Length of Time.	Specific Result.	Portions Removed.	REMARKS.
8	Joseph Schlumpt	Peterzell, Canton St. Gallen	40	1852, June 14th	White swelling of both joints; neglected case	Hectic	6 years	Death. Pyæmia	14 days	...	The whole joint	... ...
9	Bernhard Erin, journeyman	Kappel, Canton St. Gallen	30	1852, July 14th	White swelling, local cause	Hectic	6 years	Cured	26 weeks	Complete osseous union	The whole joint	Works at present during the whole day, both summer and winter, at wood-sawing.
10	Franziska Keller	Schmerikon, Canton St. Gallen	16	1852, Dec. 17th	White swelling	Scrofulous	7 years	Death	35 weeks	No union	The whole joint	As no union had set in at the 20th week, the different fragments were again resected, but without result, the constitution was too debilitated.
11	Barbara Faeh, servant	Amden, Canton St. Gallen	28	1853, Jan. 9th	White swelling, local cause	Spastic	3 years	Cured	26 weeks	Complete osseous union	The whole joint	During seven or eight weeks after the operation violent cramps were of daily occurrence, which precluded any systematic dressing. The ununited fragments were again resected in the 20th week, and firm union followed in six weeks.
12	Joseph Schwiter	Schännis, Canton St. Gallen	20	1853, Jan. 17th	Anchylosis, local cause	Good	8 years	Cured	10 weeks	Complete osseous union	The anchylosis removed to the extent of six inches	... ...

13	Augustin Rüegg	Waldi, Canton St. Gallen	18	1853, April 30th	White swelling	Tubercular	8 years	Death by tuberculosis	34 weeks	...	The whole joint	... ...
14	Rosa Häfeli, needlewoman	Niederuzwyl, Canton St. Gallen	26	1853, Oct. 11th	White swelling	Tubercular	4 years	Death by tuberculosis	30 weeks	...	The whole joint	During the first six weeks the external parts united completely, but the tuberculosis made such rapid progress that no union ensued.
15	Jacob Blumer, innkeeper and peasant	Rüti, Canton Glarus	26	1855, May 12th	White swelling; cause unknown.	Hectic	5 years	Not healed	48 weeks; was then amputated, and recovered	Fibrous union; useless limb	The entire joint	... ...

The results of these 15 cases may be thus briefly stated:—8 cured, 6 died from the effects of the operation, 1 died after amputation was resorted to, excision not succeeding.

I feel much indebted to Professor Roser, of Marburg, for the summary of the following five cases, in which he has excised the knee-joint.

No.	Age.	Date of Operation.		Method of Treatment.	Result.
1.	21. M.	1851.	Disease of 10 years' standing, with suppuration. Amputation refused.	Limb box; later, Malgaigne's screw splint.	Pyæmia delayed recovery. Amputation, with recovery after 8 months.
2.	17. M.	1851.	Traumatic suppuration—amputation refused—posterior luxation.	Limb case—Malgaigne's screw.	Phlebitis, with death.
3.	14. M.	1856.	Scrofulous — caries of condyle of femur.	Limb case.	Phlebitis, with death.
4.	16. M.	1859.	Carious fistulæ — posterior luxation—5 years' standing.	Limb case—extension with 4 pounds' weight.	Cure, with osseous union.
5.	21. F.	1860, Aug. 22.	Anchylosis—heel of left leg touching the ascending ramus of the ischium.	Limb case—extension with 4 pounds' weight.	Cure, with fibrous union.

5 cases: 2 cured, 2 died, 1 recovered after amputation.

This solitary case was operated on with success by Dr. Paul, of Breslau, and is the only one which, as far as I am aware, he has undertaken.

1 case—cured.

SKETCH OF THE HISTORY OF EXCISION OF THE KNEE-JOINT AS PERFORMED IN MILITARY PRACTICE.

Excision of the knee-joint in military practice has not obtained much attention, owing to the decided objection—theoretical in a great measure—which exists among army surgeons regarding it. The late Mr. Guthrie, while he had no direct personal experience of the operation, wrote as follows, in the year 1853:—

"Excision of the knee-joint is an operation attended until lately with so little success, that it has rarely been performed. It is probable that the result may be more favourable in cases of injury in which the femur and tibia have both been much injured by a musket ball, but without doing so much mischief to the soft parts as would have rendered amputation necessary.

In such a case, provided every accommodation, and particularly absolute rest, can be obtained for the sufferer, excision should be attempted instead of amputation."*

During the Peninsular war no opportunity enabled even a single opinion to be formed regarding the advantages and disadvantages of the operation; and the first case which appears to have been submitted to excision, instead of amputation, is the one quoted by the late Mr. Statham. "We did not at first," writes this enterprising surgeon, "attempt a proper resection of the knee-joint, because, according to the opinions of other surgeons, we considered this operation as still more dangerous than amputation of the thigh. We feared all the extensive surface of spongy bone which would remain in the wound, after removal by the saw of the epiphyses of the femur and tibia."

But one case was operated on at the close of the Danish campaign (No. 3), by Dr. Fohle, on January 3rd, 1850. The knee-joint had been wounded by a bullet. The patient went on tolerably, but eventually sank, Feb. 3rd, 1851, of pyæmia. "We were," adds this writer, "prevented from repeating the operation by the cessation of hostilities."†

During the whole of the Crimean war only one case of excision of the knee-joint was performed among the British (none, I believe, in the French hospitals) wounded. In this solitary instance, Mr. J. H. Lakin was the operator. The patient, a private in the 77th Regiment, was, while retreating from the Redan, wounded in the left popliteal space by a bullet, the ball becoming embedded in the inner condyle of the femur. Excision of the joint was performed September 29th, 1855, the injury having been received on September 5th, 1855. The wound progressed well for some time, but on October 28th the patient died of pyæmia.‡

Remarking on the propriety of excision of the knee-joint for wounds involving this articulation,* Dr. G. Macleod says: "If the operation be performed in the field, the sooner it is undertaken the better; for, although primarily free of disease, the articulation soon becomes affected, if it be left a prey to inflammation and abscess; the constitution rapidly sympathises, and that blood-poisoning which is so likely to follow may be established before we well see the danger of delay. Secondary operations too, it should be remembered, do not always hold out the same prospect of success in military as they do in civil practice."—P. 355.

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* Commentaries on Surgery, &c., &c. By G. J. Guthrie. 1853. P. 94.

† Resection in Gun-shot Injuries, &c., in the Schleswig-Holstein War. By R. Esmarch. Translated by F. F. Statham. 1856.

‡ Case of Excision of the Knee-joint, &c. By J. H. Lakin. *Midland Quarterly Journal*, January 1858.

As far as I am aware, these are the only two cases of excision of the knee-joint which have been noticed as having occurred in the surgical practice of our own army, and I fail to find any record of the operation having been undertaken by continental army surgeons on the field of battle.

They may be thus tabulated :—

	Operator.	Result.
1.	Dr. Fohle.	Died.
2.	Mr. Lakin.	Died.

In the foregoing synopsis and *résumé* of 291 cases, in which the knee articulation has been excised for disease, deformity, and accident from the year 1762 to the end of (middle of December) 1860, not only in this country, but in America and on the Continent, I have endeavoured to state,—*Firstly*, the exact number of cases with which I have become acquainted; *Secondly*, to give the name of each operator, the number of times he has performed the operation, and the result of his cases, also the nature of the mischief which necessitated the interference. In this way, although not without considerable difficulty, I have contrived to deduce the various statistics which, I have every reason to believe, are as correct as can be obtained with any degree of certainty.

Analysing still more minutely these 291 cases, we obtain some interesting information. These 291 cases have been divided among 106 different surgeons,—*i. e.*, that only 106 surgeons, during a period of 102 years, have resorted to the operation.

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* Notes on the Surgery of the War in the Crimea. By Dr. G. H. Macleod. 1858.

But to go further. It will be found, as already stated, that these 291 cases may be divided into sections, in accordance with the time of their performance and the residence of the operators, thus:—From 1762 to 1830, seventeen cases were operated on, with ten deaths.

Of the nine cases operated upon by Germans from 1830 to 1849, four died.

Of the twenty-one cases operated upon by continental practitioners from 1850 to 1860, nine died; and of 238 cases operated upon by English, Irish, Scotch, and Jersey surgeons, fifty-five died; while in six cases operated upon in America none died, so far as I am aware.

To reduce the observations to a tabular form, it will be found that—

	Number operated on.	Cured.	Died.
From 1762 to 1830 (mixed)	17	7	10
From 1830 to 1849 (German)	9	5	4
From 1850 to 1860 (Continental) ..	21	12	9
From 1850 to 1860 (British)	238	183	55
From 1852 to 1860 (American)	6	6	0
Totals	291	213	78

It has already been stated, somewhat in detail, from what causes all the fatal cases sank; but, as I have not found it expedient to give in detail every case operated upon in the table of 238 cases, embodying all the instances of the operation which have come under my notice, as performed by British and Jersey surgeons, I shall now offer a tabular form of the causes of death in fifty-five unsuccessful cases, giving these causes in a numerical order.

Causes of Death.	No. of Instances.
Exhaustion, &c.	14 Cases.
Pyæmia	10 ,,
Phthisis	5 ,,
Irritation, hectic, and secondary hæmorrhage ..	5 ,,

Causes of Death.	No. of Instances.
Shock	5 Cases.
Causes uncertain..	4 „
Chloroform and amylene combined with shock..	3 „
Pleurisy	1 Case.
Pleuro-pneumonia	1 „
Suppression of urine	1 „
Dysentery	1 „
Diarrhœa	1 „
Anæmia	1 „
Erysipelas	1 „
Peritonitis	1 „
Tetanus	1 „
18 causes.	Total, *55 fatal cases.

Of these 238 cases amputation of the limb was performed at various periods after excision of the knee-joint on thirty occasions, on account of a variety of circumstances. Of these thirty amputations, which were all through the thigh, twenty-five recovered, and five died.

The circumstances which necessitated amputation have already been mentioned when treating of the various cases which deserved independent remarks; but they may briefly be divided into main classes—viz., those in which amputation was performed during the time of treatment, *i. e.* during the first four to six months after excision, and those in which amputation was not deemed advisable or imperative till a much later period. Thus, for instance, Mr. Benfield amputated almost immediately after excision in his solitary case; Mr. Birkett on the thirty-eighth day; and myself not till two years and three months after excision of the joint.

The definite percentage of deaths in these various cases may be obtained as follows:—

In the whole number of cases—291—the operation of excision terminated fatally in seventy-eight instances, showing a proportion of one death in 3·7 cases.

In the more limited number of cases—238—performed by British surgeons, of which I have the fullest record, there occurred fifty-five deaths, showing a proportion of one death in 4·3 cases.

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* In this number are included 5 cases which died after amputation had been performed.

In these calculations I have included the five cases which sank after amputation had been performed when excision had failed.

The proportion of deaths after amputation in the thirty operations is, one death in six cases.

With these facts before us it will be possible, as well as advantageous, at once to proceed to the consideration of the following subjects, deeply interesting and important to the right study of this special operation.

As to the importance of a judicious selection of cases, so far as regards the nature, extent, and stage of the articular mischief; the state of the health of the patient; and the age of the patient.

On referring to the various tables and examples, somewhat fully recited, of cases in which excision of the knee-joint was performed, it will be seen that the operation was practised for almost all kinds of articular diseases, not of a malignant character; that it was adopted when the diseased action was in an early stage, in progress, in advance, and at a standstill; and was also resorted to when the patient was in tolerable health, wasted by the disease, rendered hectic and exhausted by pain and suffering, and reduced by pulmonary complaints. Moreover, that patients of various ages, from fifty-five years to three years and a half, were the subjects of the operations.

But although these various operations have been undertaken, in what may appear to many, a wholesale and, in many respects, injudicious manner, still, on many occasions, much care has been exhibited. I am free, however, to admit that frequently insufficient judgment has misled the surgeon in his selection of cases for operation, although it is a matter for discussion, if, under the circumstances, a resort to other means would have proved of greater avail. But without further criticism on practice which it is oftentimes impossible correctly to appreciate when ascertained from printed records and hearsay, and not from actual acquaintance, it may be well at once to state what cases of diseased knee-joints may, with a fair hope of success, be submitted to excision. Practical experience of this operation has led me to the following conclusion on this point. I believe that there is scarcely a single affection of the knee-joint in a sub-acute or chronic stage, involving the synovial membrane, cartilages and ends of the bones immediately included in the formation of the articulation, which may not, in the adult, and perhaps in the young subject, be treated by excision. Indeed, I am not disposed to limit diseased action destroying the ends of the bones directly concerned in the composition of the joint, provided only a portion of the bone remains healthy; for I have quoted two cases, under Mr. Fergusson's care, in which a considerable portion of the lower end of the femur was removed, in addition to that portion forming the joint; and also a case under the able hands of Mr. Jones, of Jersey, in which considerable portions of the tibia and fibula were removed at the time the joint was excised.

There is, however, one form of disease which I have described under the head of "diffuse strumous infiltration of the ends of the articular bones" which forbids the adoption of excision. A case under the care of Dr. Keith, quoted at some length, and one of my own, illustrate the wisdom of this exception. In both these examples amputation was resorted to on account of caries, abscesses, and useless limbs.

But to analyse more minutely those conditions which may be submitted to excision.

Firstly—Is excision a correct operation when the disease is limited to the synovial membrane, and demands complete removal from the body?

My own conviction is, that, provided no general conditions forbid the adoption of a capital operation, the proceeding is not only justifiable, but advisable. Several surgeons who have resorted to excision of the knee-joint when the disease has been, if not limited, at least for the most part confined to the synovial structure, state, that the operation has not been attended with that amount of success which anticipation expected. Indeed, some—as Mr. Spence, for instance—have hinted that the synovial mischief (for the case from which he deduced this, to me, extraordinary reasoning was one in which excision was undertaken for confirmed synovial mischief) may, in a manner, favour the lighting up of unhealthy inflammations, not only in the immediate neighbourhood, but in parts more remote. I can fancy that where no chronic inflammation in the ends of the articular bones has taken place, the exposure of the open and unaltered cancellous tissue may lead to unhealthy action invading this sensitive structure; but still I cannot imagine that specific action of a morbid character is more likely to arise after excision of a joint in which the bulk of disease was confined to the synovial tissue than it is when an articulation is removed for still more extensive disease. Another objection has been urged against the adoption of excision in instances in which the synovial membrane is solely and extensively diseased, for the reason, that its complete removal, although necessary, is oftentimes impossible. It is urged, and I do not hesitate to say with some degree of truth, that the presence of any great amount of the diseased membrane after excision of the ends of the bones is fraught sometimes, not only with inconvenience, but with danger. In more than one instance in which the operation has been performed, it has been "found impossible to take away" all this diseased structure; so that abscesses caused by the presence and disintegration of the morbid structure have rendered the cure protracted, and, in one or two instances, necessitated subsequent amputation of the limb. But while admitting, in some degree, the inconvenience complained of, I confess I see no reason why a great, useful, and conservative proceeding should be abolished for the treatment of this form of articular disease, especially when it be remembered that it is not difficult to bring home to the surgeon, in more than one example, a decided want of tact, judgment, and skill in performing the operation and treating the patient.

Having thus considered the *stated* disadvantages of excision of the knee-joint for disease entirely or for the most part confined to the synovial membrane, it is only fair to advance reasons why the immediate and future results should be all that could be wished for, in instances where the operation has been skilfully performed. In the first place, when the diseased action is confined principally to the synovial tissue, it is generally found that the bony structures are completely healthy, or almost so, and that if the cartilages are diseased their disorganization has nothing specific in character. On these grounds the operation is strictly conservative: by this I mean that only just sufficient cartilaginous and osseous structure need be removed to insure apposition of free surfaces. No disease being present in the bones, it follows that, under favourable circumstances, reparation is an immediate process. Moreover, the after result of the operation is, in every way, satisfactory. Provided that the patient be healthy, and in all probability he will be so, and if the disease be not of long duration, osseous union, or at any rate firm, tough fibrous material, will link the cut surfaces of the bones together. Again, the bones not being diseased, little, if any indeed (if the patient be young, and the operation be performed in the way so strongly and rightly, I conceive, advocated by Mr. South), of the epiphyses will be removed, so that subsequent development of the limb will be but slightly interrupted. Moreover, the immediate shortening of the limb will be less than it is after the adoption of excision for almost any other form of articular mischief.

The practical nature of these remarks will find corroboration by turning to the histories of some of the cases which I have recorded in which synovial disorganization demanded recourse to excision.

The foregoing observations are intended to apply only to chronic affections of the synovial membrane, such as the scrofulous and brown fibro-gelatinaform degenerations, &c., and by no means to acute synovial disturbance. In only one instance, out of the number of cases I have recorded, was an excision undertaken on account of acute suppuration of the synovial membrane. This case was operated upon by Mr.

Humphry, and the patient was a little girl, æt. 5 years. It will be recollected that she sank on the twenty-second day after operation. In this instance Mr. Humphry "thought that amputation and excision afforded about an equal prospect of saving life;" but I think that, as a rule, the generality of surgeons will not coincide with this opinion. From what I have seen of excisions, I am led to believe that the less amount of acute mischief there is about a joint condemned to removal, the greater the chance of success after excision. Besides the great and excited local disturbance, the general health is more or less rapidly and seriously implicated; and the constitution is, therefore, rendered more than ever susceptible to morbid inflammatory lesions. In addition the cut surfaces of the bones are inflamed, and the absorbents and veins about the implicated parts are in an excited condition, and ready to transmit unhealthy action to neighbouring or remote parts.*

I am myself averse to the adoption of excision for the treatment of acute inflammatory lesions of the joint which have their principal seat in the synovial tissue, and, from a combination of circumstances, require removal from the body.

But in a very large number of cases in which the synovial membrane is found implicated, the cartilages also will be discovered what is commonly called *ulcerated*, or, more correctly speaking, shredding, and undergoing certain changes which necessitate exposure of the osseous lamella; and so produce, in a somewhat secondary way, pain and startings of the entire limb. Cases of this description are those in which excision has been performed most frequently, and with such a varying amount of success.

Are these cases favourable, as a rule, for the adoption of excision when a capital operation is required? Looking at the pathological condition of the joint, and from experience knowing, to a certain degree, what state the synovial membrane and ends of the bones will be in, it wants but a moment's consideration to admit that, so far as local disease is concerned, the operation is one to be judiciously employed. But such disturbance in a joint is oftentimes accompanied with severe general systemic disturbance. Pain, and constant pain of a gnawing description, want of rest and sleep, and loss of appetite, with depression of spirits, have probably reduced the patient to a low and critical state. If the joint be excised, will the reduced and perchance emaciated sufferer be in a position to bear the shock of the operation, and will the natural powers be sufficient to admit of serviceable reparation taking place? Or will the patient, thus attenuated, be able to bear up against what some surgeons have been pleased to term, "prolonged and painful after-treatment?" To these queries the stern and at once convincing evidence of facts happily returns a satisfactory answer. I have quoted instances in former pages of this Essay, in which the most marked relief has immediately followed excision of the joint, and perfect reparation has taken place, although the patient has been worn down by disease for years, and, perchance, laboured under some organic disease. I know of no case which more convincingly shows the good results of excision of the knee-joint when disorganized by this form of mischief, and when the patient is not only emaciated, but the subject of pulmonary consumption, than the history of one of my own operations of excision (quoted in the Appendix, No. 7,) of the knee-joint, undertaken, and successfully brought to a termination, when the patient, a sickly labourer, was spitting blood in considerable quantities.* And while on this subject I may perhaps mention, though somewhat incidentally, that I consider pulmonary affections, when co-existing with disease of a joint, are oftentimes considerably accelerated by the pain induced by the local mischief seated in the articulation. Of this I have had considerable experience, and must honestly say, that I conceive a too gloomy view taken of the pulmonary mischief when co-existent with disease, and advanced disease, of a large articulation, frequently precludes the surgeon adopting decisive measures to rid the constitution of a serious and aggravating disorder. But while advocating timely and judicious interference with a joint considerably diseased in a patient, the subject of pulmonary phthisis, I must not be imagined to make a sweeping assertion, and say that I approve of excision of a disorganized or diseased joint, in a patient far advanced in this terrible affection. Far otherwise; for on turning to the statistics I have given of the causes of death following this operation, it will be found that in the fifty-five fatal instances, five patients fell victims to phthisis, after removal of the articulation, at periods varying from ten days to a few months. But cases will come under observation in which removal of a diseased joint in a patient, the subject of confirmed and advanced phthisis, is absolutely necessitated on account of the severe pain and additional constitutional disturbance which it excites. An example of this kind fell under my notice in King's College Hospital, about two years since. The patient (I have already quoted the case) was a woman advanced in years; she had very extensive disease, so called ulceration of cartilages, of the knee-joint. Her lungs were undoubtedly crowded with tubercles. Life was ebbing out, but the severe joint affection was rapidly hastening her end. Mr. Fergusson excised the disorganized articulation; amendment followed for some days, but the woman sank, after some time, from acute phthisis. For this operation the surgeon was by some severely criticised, and by not a few the surgery of the case was considered different and inferior to what is usually adopted under analogous circumstances. But curiously enough, in a neighbouring hospital amputation was performed under exactly similar circumstances. The patient died; but the surgery was not criticised, for it was but maintaining the well-established way of treating such compulsory cases.*

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* I think it may be laid down as a rule that excision of the knee should not be undertaken for acute suppuration in the joint. The danger attending excision in such a case is far greater than that accompanying amputation. —H. S.

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* A remarkably corroborative case occurred last year under my care at King's College Hospital, where the patient was apparently dying of combined disease of the left lung and ulceration of the cartilages of the elbow-joint. Notwithstanding the previous occurrence of hæmorrhage from the lung, I excised the joint. The patient rapidly recovered, and got rid of all his pulmonary symptoms.—H. S.

But to return. When reviewing the various diseased conditions of the human knee, it was stated that inflammatory conditions of the articular ends of the femur and tibia not unfrequently lead to implication and disease of the neighbouring articulation. I cannot help thinking that a large proportion of cases of chronic disease of the joint consist in a primary lesion of the cancellous structure of the long bones; and I am the more inclined to this belief, because since excision has been frequently adopted in lieu of amputation for removal of diseased joints, greater opportunities have presented for a closer and more intimate acquaintance with the exact nature and origin of the disease.

When simple inflammatory processes involve the spongy texture of one or both of the bones forming the knee-joint, either as a primary affection or as a secondary coincidence, the pathological changes which ensue are, if limited, highly advantageous, so far as regards excision of the joint, especially if the inflammatory mischief be tardy, chronic, and of long standing. Consolidation and compactness of the osseous tissue takes the place of the open and vascular network, so that the anatomical characters of the cancellous structure are completely changed. Is such a change, supposing excision of the joint be accomplished, advantageous? Without doubt it is; for I believe I can prove that when the cut surfaces of the femur and tibia are hard and indurated by reason of the action of a slow inflammatory change, the danger of caries, necrosis, and purulent absorption, is far less than when the bones are completely healthy.

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* I am familiar with a case where the operation was performed upon a patient evidently suffering from tubercle, and where an excellent recovery took place; but it must be borne in mind that the call upon the system is greater after excision of the knee-joint than after amputation, and that there is less chance of that call being responded to, and it would appear to me to be less hazardous to perform amputation through the knee in those cases where some operative measure is called for for the purpose of remedying excessive suffering and delaying death rather than for saving life.—H. S.

But there is a form of inflammatory lesion which is not unfrequently met with, attacking the ends of cylindrical bones. I allude to circumscribed chronic inflammation advancing to suppuration. A beautiful specimen of this form of mischief is to be seen in Drawing No. 1, page 3, Illustration 3, and was removed in the operation of excision of the joint.*

This form of disease may be met with at various stages and under different circumstances. It is, however, most frequently encountered at that epoch when the neighbouring joint has become implicated by reason of the advance of the mischief. The manner in which the articulation is involved has been fully described elsewhere, and it now only remains to see if a knee-joint so destroyed can be satisfactorily removed by excision. I have no hesitation in saying that, as a rule, excision is well adapted for such cases. I have seen many knee-joints excised where the cancellous structure was implicated in the manner described, and by a skilful application of the gouge all foreign materials filling these circumscribed cavities were efficiently extruded. So long as there is even a limited amount of healthy structure remaining, I see no reason why adequate reparation should not succeed. It has been pointed out that excavations of bone, formed by limited chronic inflammations, heal in various ways; it may be that the cavities after removal of the purulent matter which fill them are repaired by a white fibrous material, and eventually by distinct osseous material; or what is, perhaps, still more common, they are obliterated by coalescence of their walls by reason of the encroachment of the surrounding bone, which, by degrees, has become more and more compact. These processes, which every now and then we discover to have taken place, without even the knowledge of the surgeon or patient,—as exemplified in Drawing No. 1, Illustration 6,†—and, perchance, without the neighbouring articulation being very seriously involved, are, fortunately, such as occur after excision of a vitiated joint when associated with such chronic inflammatory mischief of the osseous surfaces.

* This drawing is omitted.—H. S.

† This drawing is omitted.—H. S.

I have noticed that in many instances in which this form of disease of the bones forming the knee-joint has occurred, and in part necessitated excision of the articulation, that the reparation between the cut surfaces of the bony shafts has been, if not permanently, at least primarily, of a flexible or fibrous kind. But it often becomes a question of moment to the operating surgeon, and of almost vital importance to the patient labouring under such form of articular mischief, how much of the ends of either the femur or tibia, or both, may be removed, without prejudicing materially the objects and success of the operation of excision. When this operation was first practised, it was thought imperative that the osseous surfaces divided by the saw should be perfectly healthy. As the operator became familiar with the appearance of the ends of the bones in excision after excision, he soon discovered for himself that, in a very large proportion of cases of chronically diseased and destroyed joints, the ends of the articulating shafts were more or less primarily or secondarily the seat of disease, and frequently of the nature now under consideration. He, moreover, learnt for himself, as I learned for myself, that, provided a ready exit was formed for the escape of diseased and foreign material, Nature would soon, thus aided by art, create repair, and of such a kind as would amply and efficiently answer the purposes for which the original structure was designed. Experience has proved that, provided even a moderate amount of healthy structure—one of the condyles, and a mere shell of the tibia, for instance—remains after the articular surfaces and synovial membrane have been removed, sufficient consolidation will admit the recovery of a useful though considerably modified limb. In one of my own cases I removed, by means of the gouge, several large patches of chronic inflammatory products which had replaced healthy bone structure; and although the extent of morbid material thus taken away, left the bony surfaces in an apparently unsatisfactory condition for commensurate reparation after excision of the articulation, still I had the best reason to be satisfied with the result of the operation.

I think it, therefore, may be positively stated, that circumscribed simple inflammatory conditions of the bony surfaces included in the operation of excision of the knee-joint, provided a moderate amount of healthy osseous structure be left, form no insurmountable bar to the performance of this conservative proceeding when removal of a vitiated articulation, in which the heads of the bones are thus implicated, is necessary.

It has been a debatable question whether necrosis of a portion of the articulation be a serious impediment to the adoption of excision. In many of the cases which I have recorded of excision of the knee-joint, this condition existed in a more or less prominent form. If it be but for a moment considered how portions of the articular bones, either in close proximity to or at some distance from the surface of the investing cartilage, become necrosed, and what is the process by which nature endeavours to eliminate the destroyed material, it will at once be admitted, that not only is excision of the joint, when seriously implicated and past recovery, a feasible proceeding, but one which demands on all occasions the attention of the surgeon. In Plate No. 4 is seen a beautiful illustration of limited necrosis occurring in the head of the tibia, and leading to destruction of the knee-joint by causing ulceration of the cartilages, and inflammation of the synovial membrane. Excision of the articulation was performed in this instance by Mr. Fergusson, and the patient made a good recovery.

In limited inflammation of the ends of the articulating bones resulting in necrosis, various changes have taken place in surrounding structure, which will be found highly favourable to excision, so far as the immediate and subsequent results are concerned; and, provided the extent of necrosis to be removed is not of too great an extent, I have no hesitation in saying that, as far as I am aware by personal experience and by a study of the cases which have been operated upon on account of this condition, excision is the only reasonable proceeding which ought to be adopted, especially if the lower limb be in every way healthy. But although it wants, perhaps, but little explanation and reasoning to prove that necrosis of the knee-joint may be satisfactorily treated by excision, yet, I conceive, I am now about to advocate a proceeding which, as far as I know, is of very late introduction into surgery. I allude to the treatment of cases of diseased knee-joint, associated with very considerable disease, necrosis of the shafts of the tibia and femur—those portions immediately bordering on the articulation—by a double operation—removal of the entire extent of necrosis, and an excision of the vitiated joint, both proceedings being accomplished at the same time, or on different occasions. It has fallen to my lot to see two cases in which these operations were undertaken, and I know of no more interesting examples of the benefit of excision in complicated diseases of the knee-joint. I have already referred to these examples when describing the most important cases of excision performed by Mr. Fergusson, and also of another instance in which, not only the tibia, but the fibula was extensively diseased, and in great part removed, in addition to the neighbouring joint, with the most complete success. In the performance of such operations as these, it is of the greatest consequence to do as little damage as possible to the periosteum. M. Olier and Mr. Jordan, of Manchester, have so satisfactorily shown the advantages of leaving this structure unharmed in all bone operations, in which it is desirable to have new osseous material replaced, that I need scarcely do more than say that I fully concur in the wisdom of their recommendations. But it may be argued by some who have no very practical ideas of this great operation, that the extent of disease removed may be so large that the health of the patient may be too much reduced, and the restorative powers too feeble to admit of adequate reparation. To those who would advance this doctrine, I can only say that the lesion is scarcely greater, or, perhaps, even not so extensive as in a compound fracture. It is astonishing to see, as will be presently stated, the rapidity with which these cases, provided no undue complications arise, get well, and the admirable result, so far as a useful limb is concerned, which follows.

Jœger,* who has perhaps written the best description of the various diseased conditions which may be treated by excision, allows that "caries of joints" are among the affections to which excision is applicable, but only when limited. In this opinion Chelius also coincides. There can be no doubt that so long as this condition is confined to the articular surface of the bones, the cut portions will present nothing amiss; or, in other words, no material change of structure, which can in any way militate against the operation and its ultimate success. But, if I be not very much mistaken, with apparently limited caries—that is, caries to all appearance confined quite to the articular surfaces of the bones—there is not unfrequently a morbid condition, or, at least, an alteration in adjacent bone. I have occasionally seen carious joints opened during the operation of excision, and noticed the surgeon hesitate as to whether he should proceed, after having taken away a slice of a carious articular extremity, and found the adjacent bone, although not carious, in a condition more vascular and softer, and, perchance, of a different colour than in health. Mr. Fergusson has encountered this difficulty, and, not feeling satisfied as to the exact nature of the altered bone which was cut through by the saw, forsook the intention of completing the excision, and amputated the limb. This was some years since. Latterly, however, other cases in which the same condition of bone was exhibited have been treated by excision; so that good success having been obtained, this opinion of the unsatisfactory state of the osseous surfaces has been discarded. But, although instances of this description are submitted with benefit and success to the operation of excision, still it does not follow that osseous union will bind the approximated bones together. This query, however, is of no material consequence, for it will be seen hereafter that admirable limbs may be given to patients after excision in which only a fibrous bond exists.

Under the heading of strumous or tuberculous disease of the ends of the articulating bones, I have described two varieties of disease which, according to my own belief, frequently form the cause of destruction to the knee-joint; or, at any rate, co-exist with joint disturbance. The two divisions which were insisted on, are the Circumscribed and Diffuse. Although analogous in nature, yet widely different in their effects on the bones which they involve, they demand two distinct methods of treatment when destruction has so far advanced as to necessitate operative proceedings.

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* Op. cit.

The *circumscribed* variety has met with a full description; and it now remains to see whether an articulation destroyed by it can be satisfactorily treated by excision when a capital operation is required. Cases which I have quoted show that not only can excision be adopted for the removal of a knee-joint so implicated, but that it can be put in practice with the most admirable results. But the term circumscribed is, perhaps, somewhat inadequate, and needs more elucidation. It has been already seen for the success—the ultimate success—of excision, it is advisable that the ends of the articulating bones should be healthy. Now, in this limited form of tuberculous exudation or deposition, there remain certain perfectly healthy portions of bone, as may be seen by referring to Drawing No. 1, Illustration 1,* which represents the portions of bones I removed on account of this form of disease destroying the knee-joint.

In this case, which was performed in 1856, a good recovery followed; but, as will be presently narrated, the limb, although a useful member, is—as the Photograph No. 5, Illustration 22, now shows—riddled at the site of the operation with sinuses.

Of course, without the removal of all implicated patches on the sawn surface of the bones, healing will not ensue; and even if it do, a serviceable member will not result. I believe that in all these cases fibrous and flexible union will join the bones' ends, but in what way this is generally accomplished varies. I have known instances in which excision for this form of mischief has been followed by no union, or if any but slight, *between* the bone surfaces. Fibrous or ligamentous material has been thrown between the circumferences of the shafts, and in this way sufficient consolidation has been effected.

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* This and the next drawing are omitted.—H. S.

I have the history of six cases—histories collected by my own pen and seen by myself—in which excision was resorted to for disease of this nature, and in every instance there was an absence, even after many months, nay years, of osseous consolidation. This disease is most commonly found involving the spongy bones of children; and in resorting to the operation of excision for its relief, it is all important that the extent of bone sawn through (in length) should be as limited as possible, so that a greater amount of the epiphyses than is absolutely necessary should not be removed. The gouge, as will be stated, is the tool which should clear away the disease.

I cannot too highly praise the result of excision when this operation is employed to remove a serious joint affection, and save a useful extremity.

Pleasing as it is to review practically the advantages of excision for the treatment of joints destroyed by all the foregoing kinds of disease, yet it must be admitted, even by the most charmed admirers of excision, that there are some affections involving the integrity of the knee-joint which cannot, with any form of propriety, be combated by the proceeding.

The *diffuse* form of strumous infiltration, or deposition of tubercle into the cancelli of the spongy portions of the articulating bones, is one of those diseases which a moment's consideration will show cannot be met by excision with any hope of ultimate success. I have quoted a most interesting case under the care of Dr. Keith, of Aberdeen, in which amputation was subsequently needed, after the 238th day; and in one of my own cases I was forced to resort to the amputating knife two years and three months after excision, owing to the existence of abscesses and sinuses about the parts, accompanied with constant pain, and no serviceable anchylosis.

The reason why excision of the articulation is a faulty proceeding in instances of this disease, is easy of demonstration.

It has been shown, that in a comparatively early stage of the affection, the true characteristics of the bone substance is considerably altered; and if, as Mr. Stanley has well observed, the inflammatory mischief passes beyond a certain point, the natural condition is never established. If, therefore, the bone surfaces, which are left divided by the saw, are void of their proper components, it stands to reason that no new and healthy bone will be generated therefrom. But, it may be argued, that although bony anchylosis may not result, yet suitable flexible fibrous material may, and thus a more or less useful limb be gained. I fear that the supporters of this theory are completely theorists in their ideas, for ample experience has convinced others, as well as myself, that no satisfactory conclusions will follow an excision undertaken for the removal of a joint, its various component parts, especially the osseous, being involved in this form of disease.

Reference to the preparations of the bony parts implicated in this form of disease, and removed on account of this form of strumous affection,—Preparations Nos. 1 and 4,*—will at once show how it was that no adequate repair took place, and for what reason (abscesses, caries, etc.) amputation was adopted. (See also case in the Appendix.)

In the foregoing pages have been briefly, but I trust practically, considered those diseased conditions of the various tissues composing the knee-joint which may or may not be treated advantageously by excision. But although with the pen it is comparatively easy to describe these various abnormal states of the different joint structures, and to say when they may or may not be combated with this or that operation, still it is very difficult in practice even to attempt a right solution of the exact character of the mischief, and much more so to say positively, if such and such treatment will be best adapted. I fear, therefore, that as a rule, in many cases of disease of the knee as well as of other joints, we must be content to appreciate the mischief in such a way as we best can, and not be disappointed if we are oftentimes compelled to describe a disordered articulation under the not very clear, but still comprehensive, terms of "disorganization of the joint," an "incurable joint," etc. Daily experience reminds even the most intelligent and practised surgeon, that such is the case, and each successive instance of disease which falls under his notice warns him of the danger of being too positive in his diagnosis. There are nevertheless certain headlands—certain, almost unmistakeable, signs—by which some diseased conditions may be recognised, which, when duly considered, may lead the surgeon to an appreciation—if not really absolutely correct, at least approaching thereto—of the mischief. But the question has often been asked, How is it possible to say if such and such a case is suited to the operation of excision—a capital operation being imperative? I answer that, as already stated, I believe, there is scarcely a diseased condition of the knee-joint, not malignant, which may not be submitted to excision with every hope of advantage, an exception being claimed for diffuse infiltration of the spongy tissue of the cylindrical bones forming the joint, and for those cases in which disease exists in parts too remote to be successfully included. But, again, some will say, as many very excellent surgeons have said, that although this axiom may be correct, how is it that in hospital practice, with a very large number of beds, a case is never seen which is considered suited for excision, but very many for which amputation is the only treatment? To this query I return answer, that the value, applicability, and propriety of excision is only learned practically; and I can in no way see, because some practical surgeons discard even the idea of the operation, that it is not one which is capable of meeting most necessities, and preventing the adoption of a proceeding which, under certain phases, must be considered a disgrace and discredit to surgery.

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* These preparations were sent in with the Essay.—H. S.

But to discuss somewhat more at length those circumstances which by some are said to preclude the performance of excision. And, perchance, they may be beneficially and practically considered in the following order:—

1st. The state of health in which the patient may be at the time that a capital operation is advisable or imperative, either to save life or the utility of the endangered limb.

2nd. The age of the patient.

3rd. The extent to which the soft parts may be implicated.

4th. The time that is (supposed to be) necessitated for adequate reparation to ensue.

Firstly.—With regard to the state of health, or general condition in which the patient may be, at the period at which it is expedient to resort to extreme measures for the salvation of life and limb.

One of the first objections which was raised to the general adoption of excision, as a means of treating diseased joints when all others had failed, was founded on the notion that patients who had long suffered from chronic disease, ultimately becoming more acute and leading to still further depression, were, as a rule, incapable of bearing the shock of such an operation, and sustaining the drag upon the constitutional powers which adequate reparation would entail. To refute an argument so shallow and so theoretical, it is only necessary to invite attention to the histories of some of the cases which have been successfully submitted to the proceeding; and it will be seen that, provided the operation be skilfully performed, and the after management judiciously carried on, the result often surpasses even the most hopeful expectations of the surgeon. I have already alluded to the influence which pulmonary complications—so frequent in many instances of so-called scrofulous disease of the joints—are supposed to exercise on the performance of any capital operation; and in case I have not sufficiently endorsed my opinion on the point, I would again assert that I believe the earlier stages of phthisis, and even perchance those more advanced, do not very frequently so seriously militate against excision of a vitiated joint as is generally supposed. It is, I am convinced, far easier for the constitution, however much depressed, to exert new and, perhaps, taxing energies for the production of repair, than it is for it to bear the exhausting depression of disease. In one case there is freedom from anxiety and hope of ultimate cure; in the other there is nothing but dejection and the faint glimmer of protracted trust that is rendered day by day fainter and less encouraging.

But there are many other diseased conditions of important organs which more or less antagonize the adoption of excision. Organic mischief of the internal viscera offers serious obstacles to the performance of any great operation; and so, what really militates against excision, does so against other kinds of surgical interference. In short, I am not myself convinced, that because the patient may be greatly reduced in health, he is unfit to undergo the operation of excision, or incapable of sustaining the drag, as some are pleased to term it, of a plan of treatment which necessarily demands time and attention, but which, if duly managed, is free from pain and annoyance.*

* The point under consideration is, perhaps, one of the most important in connection with the operation of excision of the knee-joint, and I believe it is one upon which much misapprehension exists. I cannot forbear stating, after having carefully watched the progress of a large number of instances where this operation has been performed in the hands of my colleagues, myself, and other surgeons, that I completely endorse the statement of the author in reference to the opinion just expressed. It is somewhat difficult of explanation; but still it is a fact, that in several of those cases where the health of the patient seemed to have been most shaken by long and painful disease of the joint, and where even there appeared to be symptoms of phthisical disorder, the results of the operation were in the end most satisfactory: whereas in several of the cases in which the constitution has not suffered much from the local disorder, and especially where the excision was adopted merely to remedy deformity, the health being otherwise good, the issue has been remarkably unfavourable. I think we may assume that in the one case the system has been so accustomed, as it were, to the irritation of the local disease, that it does not feel the shock of the operation; nevertheless, when the offending cause has been removed, the powers of nature assert their supremacy, and the relief afforded by the aid of the surgeon is surely, although in some cases but slowly, exhibited by an ultimate rallying of the patient; but in those instances where the local suffering has

But the state of constitutional power in which the patient may be at the time of operation, not only militates against the adoption of excision, so far as the immediate result of the operation is concerned, but it also materially affects the after result; and it will be seen, when speaking of the various forms of anchylosis which obtain after excision of the knee-joint, that the character of repair is influenced both by local and general conditions: for, let the mechanical treatment of the member be as perfect as possible, it will be disappointing in its results provided the constitutional or general powers be materially impoverished. I have myself often been struck with the immediate good effects which, more or less directly, follow the adoption of excision of this joint for chronic disease; and I could only desire, that many of the most bitter opponents of the proceeding would satisfy themselves on this single point, for then I should be sure that want of adequate information and falsely conceived views were the cause of unmerited opposition.

Secondly—The extent to which the operation is influenced by the age of the patient.

As already observed, in a former portion of this Essay, excision of the knee-joint has been practised at all ages, as well as under various conditions.

Mr. Kendall has resorted to it at the age of 3½ years, and an American surgeon at the age of 55 years: in both

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not been so great or prolonged, the constitution feels the shock of an operation more acutely, and a patient in moderately good health will succumb quickly either from the immediate effect of the proceeding or from some acute mischief rapidly set up. I feel sure that those gentlemen who, with myself, have watched the progress of the cases at King's College Hospital will agree with me in the above statement.

I may mention that I have particularly noticed this in reference to another class of operations which used to be frequently adopted ten or fifteen years since. I allude to the old and modern methods of perineal section for stricture. We found that those patients who had suffered for a long period from all the miseries of stricture, fistulæ, and urinary irritation, did by far the best after these operations; whereas those who had an unbroken perinæum and were in fair health not unfrequently died, apparently merely from the shock produced upon the system, not accustomed to much and prolonged irritation.—H. S.

instances the best success followed. But it does not result that because the operations in these instances were followed with success, that the proceeding is, of necessity, of advantage at all ages. I am not myself inclined to build up hopes and fears, and stamp new ideas and fresh forms of practice, by successes and disappointments, ere adequate experience has enabled an impartial judgment to be matured. The mode of performing lithotomy may, in these days, for instance, be influenced in the estimation of many by the "complete success" of a single case; but the questions regarding an operation of almost equal importance, must not be so disposed of. The excision of the knee has been objected to as an operation inapplicable to the treatment of diseased conditions of the joint in young children, for two reasons. The first,—doubtless the most conservative, though, alas! not the most correct,—that operative measures are never needed (provided due care and skill be exercised) for diseased conditions of the joints in persons of tender years. I need, I think, scarcely stay to refute an assertion which meets with daily exceptions. No one can desire to be more conservative in his notions of surgical diseases and their remedies than myself, for I consider the highest attainment of surgery to be the non-performance of operations,—the non-mutilation of the human body in all instances where skill, care, and attention can bring about a successful result; yet, notwithstanding these views, experience teaches that operative measures are often compulsory, even in cases where the solicitude of the surgeon is most anxiously engaged.

The second reason that has been advanced against the propriety of performing the operation in children—children below puberty—is that the limb, after removal of the diseased articulation, ceases to be developed at a rate corresponding to that of its fellow. How far this assertion holds good, we shall see by an impartial inquiry into the results of cases which have been undertaken in young children. But before proceeding to examine the veracity of this opinion of the non-development of the limb after excision, it may be well to turn for a moment to the consideration of certain physiological and anatomical facts in connection with the growth and nutrition of cylindrical bones, and especially of the femur and tibia.

It has been proved beyond dispute, that long bones grow mainly in two ways—in length, from their epiphyses; and in thickness, from the periosteum, by which they are covered.* The development from the periosteum, however, is dependent on the activity of its vascular network. In addition, increase seems to depend, in some measure, on the dilatation of the primary cancelli and Haversian canals in the central parts of the bone.† Admitting the correctness of this explanation as to the growth of a long bone in a young subject, it will be at once apparent, provided the entire or greater part of the epiphyses from the articular ends of the femur and tibia be removed, why an arrest in the further development of the imperfect limb (so far as the bony shafts are concerned) should ensue.

Does it then result, that a limb from which the joint has been excised, the subject of the operation being a certain number of years below puberty, should not increase in size, or exhibit, after a period of time, a palpable arrest of development? I am inclined to believe that if the epiphyseal cartilages be taken away by operation, ere the full growth of the bone shaft is completed, that this condition will obtain; but although I lean to this physiological explanation, I must admit that there are certain other reasons —such as the pre-existence of disease in the joint itself, in the very structure which supplies the elements of continuous growth, and in other component tissues—which, not only by exerting a morbid, but a mechanical influence on the general health and local condition, may partly account for the subsequent want of adequate development of the limb when left without the source of future growth.

I believe that this explanation is the correct one, because it is a fact which may be proved by turning to some of the illustrations accompanying this Essay. If the operation of excision be performed on an adult, little or no perceptible difference will be observed between the development of the two limbs at a period of some considerable time after operation; but if a similar proceeding be adopted on a young subject, and such an amount of bone be removed as is seen in Photographs Nos. 5 and 6, Illustrations 21 and 22,* I have no hesitation in saying, that the want of subsequent growth will very shortly be apparent.

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* Virchow's Cellular Pathology, &c. Translated by Dr. Chance. 1860.

† Todd and Bowman's Physiology, vol. i. p. 123.

Abundance of evidence has proved of late years the truth of this statement, although there are some surgeons who, without the least practical experience on the subject, assert that such an after-result is not only improbable, but impossible.

Mr. Syme was the first surgeon who drew attention to this point, for he found that the limb of a little patient, the knee-joint of which he excised in 1830, after the lapse of time, failed to grow at a rate corresponding to that of its fellow.† Mr. Butcher and other surgeons who have written on the subject of excisions seem inclined to disbelieve the fact that a cessation of growth will be apparent in the limb from which the epiphyseal cartilages have been, in childhood, removed.‡ At the periods when Mr. Butcher endeavoured to maintain his opinion regarding the adequate development of the bony portions of a limb after removal of the knee-joint in young children, he was influenced by the experience—then somewhat limited—of some excellent surgeons. For instance—Mr. Page, Dr. Keith, and Mr. Jones, of Jersey, lent their testimony to the non-arrest of growth of the limb. But since this period, from 1856 to 1858, two at least of these last-named authorities have been compelled to withdraw their opinions on this point. Mr. Jones wrote in 1856, that it was his firm conviction that Mr. Syme's views were not correct regarding the want of growth of the limb operated upon,* and gives an example to prove his point; but now, in 1860, in a letter to me on the subject of excision of the knee-joint, this able surgeon writes:—"I am satisfied, however, that some of my cases have had short limbs,—that is, have not kept pace with the excised one, but this has not always been the case; and if the limb has been some five or six inches shorter, still it is a far better—very, very far better—one than a wooden one; and I make no doubt that one of these days we shall find out some new plan by which the limb will not lose in growth." (Dec. 4, 1860.)

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* These illustrations are omitted.—H. S.

† Contributions to the Pathology and Practice of Surgery. By James Syme, F.R.S.E. P. 225.

‡ Memoirs on Excision of the Knee-joint. By R. G. Butcher. 1856 and 1858.

Dr. Keith, writing in 1859, regrets that he cannot report so favourably of the state of the limb (the knee-joint of which was excised in 1853), as he did three years since to Mr. Butcher, when he wrote:—"The limb is plump and growing; his shoe heel contains a wedge of cork, one and a quarter inch thick; with this he runs, seldom taking time to walk."

To Mr. Pemberton this excellent surgeon writes, October 12th, 1859, regarding the same case:—"He is now a healthy boy, in his fifteenth year; his left, or sound limb, long and well developed. His right limb (the one operated upon) is really plump to look at, but seems a mere appendage to his body, when compared with his other limb; the right limb being now *seven inches* shorter than the left limb, from the anterior superior spinous process of the ilium to the heel."

Again confirming this interesting point, regarding the non-development of the limb after excision of the knee-joint, with a greater or less extent of the epiphyseal cartilages, at a rate equal to that of its fellow, I invite attention to Photographs Nos. 5 and 4, Illustration 22, of a case of excision of the knee-joint which I performed in May 1856, and fully recorded in the Appendix, containing the histories of my seven cases of excision of the knee-joint.

It will be seen that shortly after the operation, about one year and a half, the Photograph No. 1 shows that the length of the two limbs does not differ very materially; but in the Photograph No. 2, a considerable difference in length will be at once apparent.* This last picture was taken in December 1860.†

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* Op. cit.

I could quote various other cases, illustrating the want of adequate growth in a limb after its knee-joint has been excised at an early period of life, but I consider the above sufficient for our purpose.

But it may be asked, supposing that the want of future development is, in reality, owing to the fact of the epiphyseal extremities being removed, how can this be prevented? Or, if it cannot be, is the operation of excision of the knee-joint in young children an advisable proceeding, and one which will be of advantage to the patient in after years, and reflect credit on surgery? On these two points I have opinions which, I believe, will be shared by the majority of surgeons; and, as far as my experience and information go, by the generality of patients who are submitted to the operation.

But, firstly, can the operation of excision of the knee-joint be performed in such a manner as to negative the assertion of a late writer on the subject?—"that ultimately the member becomes not only useless, but is an incumbrance, as it has failed altogether to grow in proportion to the general expansion of the frame."‡ If this result depends upon the method *ordinarily* adopted by surgeons in the performance of the operation of excision in young children, I think Mr. South and his colleagues have, at St. Thomas's Hospital, shown that there seldom exists a necessity for taking away such an amount of bone as will materially interfere with the epiphyseal portion of the lower end of the femur and upper extremity of the tibia. Mr. South in his operations merely takes away the articular cartilages without in any material way interfering with the subjacent structure in all cases in which the expanded portions of the femur and tibia are not seriously implicated in the disease. Reference to Photograph

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* It will be seen that these two photographs exhibit apparently two distinct (reverse) legs, but the mistake is readily appreciated when it is remembered that the artists have varnished the pictures one on one side, the other on the other.

† These illustrations and the next spoken of have been omitted.—H. S.

‡ On Excision of the Knee-joint. By Oliver Pemberton. 1859.

No. 2, Illustration 21, shows the excellent result which has been obtained in one of a series of cases so operated upon.

On looking over the various features in the history of the 291 cases which I have quoted, as occurring in civil practice, I find that with comparatively few exceptions very considerable portions of bone have been removed, far greater than, it would appear, there was any necessity for. But how has this arisen? I believe from the fact that surgeons in performing this operation failed to give due consideration to the after results of their cases. Mr. Humphry,* and subsequently myself,† pointed out the fact that, if the epiphyseal portions of the two bones were removed, no adequate development in the course of time would result, provided that the patient was under the age of puberty, or even older.

How the operation can be performed, in the way advocated by Mr. South and others, and in what way the treatment can be satisfactorily adapted, will be presently duly considered. But there are some excellent authorities on Practical Surgery who, if not entirely, at least in a great measure, dissent from the views I have expressed regarding the want of subsequent development ensuing in the limb of a young child the knee-joint (including the epiphyses) of which has been removed on account of disease. Now, it cannot be denied that the effect of a diseased knee-joint is serious upon the growth, muscular development, and utility of an entire extremity; and that even long before excision is performed for its relief, and the good of the whole system, considerable disparity in length, circumference, and aspect has obtained between the two limbs. It is a known fact that disuse of a limb induces atrophy of its various structures and their component elements, but that on restoration to health amendment rapidly ensues. In paralysed limbs the same conditions are traceable; but let the cause of the mischief be removed, improvement in the functions of the member takes place. I think, therefore, that the disparity arising, after excision of a knee-joint, between the healthy and impaired limb, so far as growth in length is concerned, in young children, can only be satisfactorily explained on physiological grounds, such as I have stated, although it cannot be denied that the effects of previous disease exercise some considerable influence on the future progress of the member.

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* Med. Chir. Trans., vol. xli.

† On the Treatment of certain diseased Conditions of the Knee-joint by the Operation of Excision. By P. C. Price. 1854.

But it is a point of interest to inquire in what portion of the entire bone (supposing osseous anchylosis has resulted) does this real disparity of growth take place. Mr. Barwell, in a letter* published in 1859, believes, indeed he has demonstrated the fact, in some of the cases of children in which non-development is traceable, that the growth of the femur (the lower portion) is only half as great as that of the tibia. In Dr. Keith's case, already quoted, the sound limb measured thirty-four inches from the anterior superior spinous process of the ilium to the sole of the foot; seventeen inches from ilium to centre of patella, and seventeen inches from centre of patella to sole of foot, while the limb which was operated on measured only twenty-seven inches—twelve and a half inches from ilium to centre of patella, and fourteen and a half inches from centre of patella to sole of foot. Thus, as Mr. Barwell says, "We lose four and a half inches in the length of the femur, and two and a half inches only in the length of the tibia, showing sufficiently closely within the one-sixth of an inch, the law of double loss of growth from the femur."

(In this case, I may mention that about equal portions of the femur and tibia were removed.)

It will be seen also, on examining the photograph of one of my own operations taken four years after excision (No. 5, Illustration 22†), that the femur appears not so well developed as the tibia.

These are features in the development of limbs after excision which have not yet met with due attention; and my own observations will not allow me to speak with greater positiveness than I have done. I may, however, remark that it is highly probable that such an explanation is correct, when it is remembered that the axis and functions of the various tibial and femoral epiphyses are somewhat different.

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* *British Medical Journal*, Dec. 24, 1859.

† This illustration is omitted.—H. S.

To show that these observations in no way apply to the adoption of the operation in adults, it is only necessary to turn to some of the illustrations accompanying this Essay. I cannot, however, pass over the notice of a case which, although it will be presently more particularly referred to, is peculiarly interesting as illustrating a feature of importance in connection with the subject now immediately under consideration. I allude to the case represented by Photograph No. 1, Illustration 21,* which was the second one operated upon in London by the reviver of the operation of excision of the knee-joint. It was performed in 1852; the patient, a girl, æt. 21, was a sufferer from acute ulceration of the cartilages, &c. Union has never ensued by osseous material, and the limb, although highly useful, is, nevertheless, unable to afford complete support to the body, when she is undergoing much fatigue—the use of a side iron splint being necessitated.†

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* This and the next drawing alluded to are omitted.—H. S.

† It is impossible to overlook the importance of the question as to the arrest of development of the limb after excision of the knee-joint has been performed upon children or young persons, and the author has evidently felt the force of the objection which has been brought to bear against the operation by some surgeons who are inclined to receive excision of the knee-joint with favour. This point in question is so well handled by the author that there is little left for me to say; but as a good deal has been said upon this matter since these remarks were written, and as several opportunities have occurred by which I could test the value of his reasoning, I may mention that experience teaches us that the limb will be almost entirely arrested in its growth provided the entire epiphyses be removed, but on the other hand, if only one-half be left, the limb will grow, although probably not in proportion with the other. We are, therefore, taught the great practical lesson, to avoid operating by excision in those instances where the disease is so extensive as to pass beyond the epiphyseal junction,—at least if we wish or expect the member to grow afterwards. Fortunately, in by far the majority of cases, the disease is so far limited that a perfect excision of the joint may be effected by taking away a very thin slice of the hard tissues. In the last case under my own care there was the thinnest possible slice removed, both from femur and tibia; and in a remarkably successful case of the late Mr. Jones, of Jersey, there was such a small amount of bone removed, that when the preparation of the limb was shown some years afterwards—the patient meanwhile having

The second important consideration may now be entered upon—"Is the operation of excision of the knee-joint an advisable operation for the treatment of disease of the articulation in young children, and one which will reflect credit on Surgery?" On looking at such a picture as that presented by Photograph No. 6, Illustration 21* (a copy taken from one of Mr. Pemberton's cases, as figured in some of his papers on the subject of excision), it might become a question with some surgeons whether a limb which was so much shorter, and one which is liable to show even more disparagement in growth, is really a useful member, and one more to be valued by its possessor than a wooden stump? Whatever may be the opinions of surgeons on this point, I believe (for I have asked every person with whom I have come in contact who has undergone the removal of his joint, and the answer has, with no single exception, been different, provided some degree of utility has been obtained) that rich and poor, high and low, prefer the retention of a moderate limb to the loss of the same, and the substitution of a wooden peg. There is a feeling of conservatism about patients which it is the duty of a surgeon always to uphold, although it may be that the fruits of his handiwork do not always answer his expectations, or, in his own estimation, sufficiently repay him for all his trouble and anxiety. Besides the existence of a natural pride on the part of sufferers to preserve as intact as possible the various members of their body, there is, at least, so I have long thought, a still higher influence which exercises a distinct moral control over such wishes and desires, which leads them to exclaim in the words of John Hay, a patient of Dr. Keith, "My leg is worth a thousand wooden ones; it is my own leg, sir, and I feel it to be so;" while the opinion of all surgeons, under similar circumstances, must, I think, be that of their distinguished Aberdeen brother, "I dare say the poor fellow is right!"

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died of some other disease—at one of our societies, the foolish objection was raised, that the case could not be considered as one "of excision of the knee-joint, because so little had been taken away."—H. S.

* This drawing is omitted.—H. S.

A third objection has been made to the adoption of excision of the joint, in certain instances, on account of the extent to which the soft parts are sometimes involved.

When first the operation of excision was proposed for the treatment of diseased and destroyed joints, it was thought that soundness of the integument covering the articulation and adjacent parts was indispensable to the acceptance of the proceeding. Experience has now taught that the integuments being even considerably implicated form no material bar to the removal of the joint. The rapidity with which healing action ensues after the cause of mischief has been taken away is a fact familiar to all; and even Boyer must have revoked his opinions regarding the inapplicability of excision when the skin and cellular tissue are much involved, if he had but seen some of the instances in which excision has been performed with complete success, although the abscesses, ulcerations, and sinuses of the cellular structure were considerable.

But there is no tangible point so exposed to the willing grasp of opponents of this great conservative operation, as that which has been termed "the great extent of time which is required for cases of excision to make good recoveries." The length of time which is required for adequate reparation to ensue is so dependent on various circumstances that, I fear, it cannot now be duly discussed. Much depends on the skill and tact of the surgeon in conducting, as I shall presently show, the various steps of the mechanical as well as therapeutical treatment; while, perhaps, even greater necessary requirements must be forthcoming from the patient, such as a due amount of healthy action, not only local but general, and such assistance as he can render by keeping his limb at perfect rest. Again, various agencies, over which neither patient nor surgeon can exercise any control, occasionally prove drawbacks to quick recovery,—as, for instance, hospital affections, as erysipelas, inflammations of various kinds, &c. &c.

But speaking from the results of a large number of cases which I have seen treated, and of which I have descriptions, I find that adequate repair cannot well take place before the lapse of at least six weeks, even if the patient make the greatest progress; while the treatment may have to be prolonged for an almost indefinite number of weeks, and even months. But is the uncertainty of being able to fix the exact time for recovery after excision an honest reason why a great and undoubtedly a good operation should be abandoned? I am sure a moment's consideration will at once disclaim even a thought of such a reason; and yet, with some surgeons, it would appear, even still more inadequate and, to my own mind, less weighty reasonings exercise a baneful influence over their just considerations. Thus, while a surgeon is priding himself on having, for the first time, successfully performed excision of the knee, and been the means of giving to a patient a most useful limb, he allows the character and attainments of his skill, and the material advantages of his pauper patient, to be influenced by the reflection that "he left the hospital as an out-patient, after having expended an inordinate quantity of steel, quinine, ale, porter, wine, &c., during the four months of his stay." On looking at the admirable result which followed in a measure, doubtless, from the *inordinate* quantity of medicinals, and nutritious drinks, and etceteras which this patient imbibed, I think that the surgeon had but slight cause to regret the expenditure of public funds.

But although it has been urged that the immediate result may be all that could be desired, still a considerable time must elapse ere a moderate amount of utility will be afforded by the kneeless limb. On this point I shall reserve any remarks I may have to make till the subject is more fully discussed at a more distant page.

PART III.

ON THE VARIOUS WAYS OF PERFORMING THE OPERATION OF EXCISION OF THE KNEE-JOINT.

THE weakest upholders and admirers of operative tact and skill will, I imagine, freely admit that on a correct performance of a great and important operation depends, in a measure, its ultimate safety and success?

From the time that Park first clearly devised this proceeding for treating diseased conditions of the knee-joint, it appears to me that surgeons have vied with one another in inventing new methods of cutting and sawing the flaps of skin and ends of bones with a greater zealousness than occasion requires, and in so doing have lost sight of many more essential features connected with the general adaptation of the operation.

Reference to Photograph No. 1, Illustration 20,* will at once show what surgical instruments are necessary for the performance of the operation.

With regard to the nature of incisions best suited to expose the joint and allow of the joint ends of bone being easily removed by the saw, I believe, the most convenient one will be found to be that taking the shape of a letter H, or one shaped in this way, U, which enables the cavity of the joint to be at once exposed. But according to the fancy of the operator may be the nature of the line of incisions, although they may need modification by reason of any diseased condition and deformity. Park, Moreau, Mülder, Syme, &c., have all had their special incisions. I have usually preferred either of the two incisions above described, although I have seen the joint easily removed through a single longitudinal incision running over the surface of the joint. The semilunar or H incisions are, nevertheless, of the greatest value, because they allow of easy manipulation, and admit the exit of all discharges and subsequent secretions.

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* This drawing is omitted.—H. S.

Having dissected back the flaps of integument, and opened the joint cavity by dividing the anterior and lateral ligaments, the ends of the femur and tibia may be removed to the required extent. I have already alluded to the various opinions which exist as to the extent of bones which should be taken away. The usual plan is to remove a considerable slice, often as much as two inches in length of the condyles, and half an inch to three-quarters of an inch of the tibia; but the amount that it is requisite to remove is dependent on circumstances. Thus, when there is considerable deformity at the knee, the tibia being drawn close to the under surface of the femur, it will be found extremely difficult to remove the upper surface of the tibia to a line with the projecting condyles of the femur, without cutting off a considerable amount of both bones. The steps of an operation of this nature, although not advisable, are nevertheless compulsory; and it is, therefore, unfair to blame the surgeon on all occasions when the ultimate result of his handiwork is not so perfect as it would otherwise have been. But when no reasonable cause exists for removal of so much bone, I am sure that the surgeon errs, in general, in taking away too large portions, especially if the operation be one on a child. The reason for being as conservative as possible in the use of the saw has been elsewhere explained.

Instead of using a saw,—such, for instance, as figured in the photograph in which the necessary instruments are shown,—Mr. South and other surgeons prefer using a thick strong-bladed knife to cut through the articular cartilage, which in children is generally sufficiently soft to admit of easy manipulation. Whatever instrument be used to cut the bones, let it be borne in recollection that the smaller the amount removed the better will be the result, especially in children. But it may happen, as I have seen it do more than once, that insufficient removal of the ends of the bones has led to severe injury of the cut cancellous surfaces of the osseous shafts by reason of the amount of force which has been needed to get the bony planes into suitable apposition. When such a difficulty has to be surmounted, it is better to divide the hamstring tendons, which may offer considerable resistance, or at once proceed to take away more of the bone. I regret to say that I have seen one, if not more cases, prove fatal by reason of the damage which was inflicted on the spongy structure by means of a too forcible manipulation, which was needed to place the cut surfaces in apposition.

Whatever instrument is used to cut the bones, care must be taken that the posterior ligament of the joint be not wounded, or else the popliteal vessels may be placed in jeopardy.

Care must always be taken to remove as much of the diseased synovial membrane as possible, for it has already been stated that some surgeons have raised an objection to the operation when this tissue is very much implicated, owing to the liability there exists to the formation of abscesses, sinuses, &c.

It is important that all hæmorrhage should be arrested, although there is seldom any bleeding of consequence. In two instances, however, among the number of cases I have quoted, death was rendered imminent by the occurrence of secondary bleeding. When such occurs, it is better at once to search for the bleeding vessel, and not to mop and sponge the parts with turpentine, as I have seen unwisely done on two occasions.

Some years since, when surgeons were busy in trying to save the entire patella, I was greatly puzzled about a case in which I had excised the joint and left this bone in an apparently healthy condition. The case progressed well for some time; and just as convalescence was complete, abscesses commenced to form about the parts concerned in the operation. For some time I was anxious about my patient, as it was not improbable that caries or necrosis might be attacking the ends of the femur and tibia. An examination, under chloroform, at once showed me that the patella was contained in the sac of an abscess and was carious. It was removed, and the patient recovered. An analogous case, already referred to, subsequently occurred to Mr. Fergusson in King's College Hospital; while Mr. Bowman probably hastened the death of one of his patients by failing to discover that the patella was firmly wedged in between the two bones.

I now always remove this bone.

There are other points of interest in connection with the performance of this operation, but they call for no special notice in these pages.*

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* At the time of these observations the operation was usually performed in the manner detailed, but a considerable modification has been effected in a very important part of the process, viz. the external incisions. Those referred to by the author enable the surgeon most readily to get at the diseased parts, and thus the operation may be completed in a shorter period, but extensive incisions in such a situation are undesirable, if they can be obviated, for more reasons than one; and during the last two years the old methods spoken of by the author have been laid aside, and a single transverse incision carried across the knee just below the patella is found to give ample room for exposing the joint, and applying the instruments necessary for the excision. For this plan of operating we are indebted to Mr. Fergusson. I have used this incision myself on two occasions, and can testify to its being quite sufficient for the purpose, although possibly the operation may be rendered slightly more difficult. The little amount of disfigurement noticed in a limb immediately after operation by means of this incision, as well as after a complete recovery has taken place, is a great argument in favour of its adoption.

With regard to the section of the bones in excision of the knee-joint, I believe that this is by far the most important and difficult part of the operation and requires much care, and each case must be studied according to circumstances. For my own part, I should never think of using anything but a saw, even in children,—either a common short amputating saw—the saw employed by Dr. Butcher—or one of the small saws furnished with a moveable blade. The use of the stout knife alluded to by the author is a most questionable proceeding, and I am astonished that he has not exercised his satirical powers in condemning its use, for I shall never forget accompanying him to see an excision performed upon a child by a surgeon who used such a knife to remove the ends of the bones. My poor friend could scarcely maintain his gravity as the surgeon was making his cuts in most dangerous

TREATMENT REQUIRED FOR THE LIMB AFTER EXCISION OF THE KNEE-JOINT.

There is, perhaps, good reason to believe that the most unfortunate results have occurred from inefficient mechanical

proximity to the popliteal artery, which we expected to see wounded every moment. Surely a saw, lightly and skilfully applied, can do no more damage to the bones than a thick knife, and the surgeon can control the action of his saw, but he cannot sufficiently limit the extent of his incisions when they are being carried through a cartilaginous tissue, and a sudden slip at the back of the joint would be fatal.

I think that it is better, in cases of very great deformity, to divide the hamstring tendons, if they are very tense, before commencing the operation. An immense amount of trouble may thus be saved; and as a very bad impression regarding the nature of the operation is made upon the lookers-on by the necessity of making further applications of the saw after the first sections in order to get the parts into apposition, and as the operation is thereby much prolonged, it is of the utmost importance to determine upon the extent of bone which should be removed. And by care this may be effected almost with exactness, and, with a single section at each end of the joint, the parts may be brought at once into the nicest apposition. This is one of those matters of detail in connection with this operation which is of so much importance to attend to, and the neglect of which may spoil the whole proceeding, both as regards the result of the operation and its being a lesson to pupils.

The author, perhaps, has not laid sufficient stress upon the possibility of wounding the popliteal artery. It certainly ought not to be in danger in ordinary cases, and if ordinary care and skill be exercised; but, under certain circumstances, this vessel will be in more danger than it is thought to be, and I know of two instances where this artery was wounded by surgeons of large experience, with the effect, of course, of being obliged to resort to amputation. Therefore, I say, the surgeon must be very careful as he is carrying his saw to the back of the joint, and, above all, he must be cautious with his knife as he is dissecting the sawn portions of bone out of the wound: he should have the wound well sponged, and keep the point of the knife well on the bone, and then no harm can arise.

As the author states, it is of the utmost importance to arrest all hæmorrhage at the time of the operation; for although the small arterial branches which are wounded may cease bleeding at the time, so soon as the patient has rallied from the effects of chloroform and the shock of the operation, these vessels will pour out blood in large quantities. In one instance, most certainly, I saw a child perish from excessive hæmorrhage, the result of neglecting to tie the divided vessels at the time of the operation; and, in one or two other instances, the bleeding has been so great as to necessitate disturbance of the wound and application of ligatures. This ought never to be. I make a point of tying every bleeding vessel, however small it be.—H. S.

treatment of the limb after removal of the knee-joint. It has been mentioned how this operation has failed in the hands of some of the best surgeons who have resorted to it, mainly from inattention to the necessary subsequent management. Foreseeing the grave consequences that would result to the progress of the operation, I some time since described a splint well suited to the treatment of cases of excision of the knee. This is figured in Photograph No. 2, Illustration 20,* and the picture represents the limb of one of my patients. I conceive that this instrument embodies all the advantages which can be desired, and I have the more reason to think this because I have used it in all my cases, and have found it in frequent demand by those who resort to excision of this special joint.

Other apparatus may be used with advantage.

Mr. Butcher, whose name is so intimately associated with operations of this nature, prefers a box; and Mr. Heath, of Newcastle, a splint of his own contrivance.

Both these are figured in Photographs Nos. 3 and 4, Illustration 20.

Whatever be the nature of the mechanical support, it is all important that *rest*, complete rest, should be maintained between the surfaces of the two bones. If movement be allowed, it is more than probable that a false joint or an insufficient union will result. Moreover, still worse results may accrue. Irritation of the bones may ensue, and lead to amputation or even death, as, alas! too many instances have shown.

My own plan, and, I believe, the plan now generally adopted, is to place the bones in contact *immediately* after the operation, and allow them to remain so, till a positive bond of union has resulted. Mr. South, however, informs me that he is not precise on this point; and if in the course of time he can bring the ends of the bones into apposition, he is well content. Meddling treatment is always bad, and I am not saying too much when I insist upon the great importance of leaving the limb, when once in position, untouched.

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* This and the next drawings are omitted.—H. S.

The last time I resorted to this operation, I placed the limb in the splint immediately after operation, and did not *once* remove it till the sixth week, when the man got up on crutches.

Much will depend on the progress of every case of excision of the knee-joint, as to whether active therapeutical treatment will be needed. In the majority of cases, the notes of which I have collected, I find that little medicinal treatment was needed.

To allay pain, opium is, however, often required; and to support the system, there is nothing more valuable than brandy and chloric ether. I find, however, that these cases, provided moderate progress is made, require nothing more than good mechanical treatment, and suitable diet. But much depends on the constitution of the patient, and the nature of the disease for which the operation is undertaken.

AS TO THE UNION WHICH TAKES PLACE IMMEDIATELY AFTER OPERATION, AND OF THAT WHICH SUBSEQUENTLY OBTAINS.

In the adult after excision the character of the anchylosis which results may be of two distinct kinds—either fibrous, flexible and yielding, or osseous. Further, it may occur that union of a mixed character may result. The nature of the anchylosis depends, I believe, on two main circumstances: *firstly*, on the method of mechanical treatment which is employed, so as to enjoin *absolute rest; secondly*, on the constitutional diathesis of the patient, and the powers of reparation.

In children, the same remarks are applicable, although not with equal force.

I believe that the union, in the majority of instances, which results is, primarily, fibrous, and eventually becomes fibro-osseous, or completely bony. I do not think that true *Callus* often results after these operations, and I see that Moreau and Jœger have recorded the same opinion. I deduce my observation from manipulations of various limbs at varying periods after operations, and from an attentive examination of morbid specimens.

Immediate osseous union does, however, sometimes result especially in adults; but to insure its fulfilment, some French surgeons have advised that the periosteum should be saved. But how this is to be done I scarcely know, considering that, on many occasions, the condyles are removed at a point on which there is no periosteum! Sometimes in adults, even those perfectly healthy, and in those instances also in which absolute rest has been obtained, a pure fibrous union will result, admitting more or less of movement. In one of Mr. Fergusson's cases, that of a girl, æt. 19, this condition was well illustrated, a most useful limb resulting, and enabling the patient to obtain her livelihood as a general servant.

In another instance, occurring in the practice of the same surgeon, there exists, even after eight years, a distinct fibrous and flexible junction between the bones, but by the aid of a support this patient, a young woman, is enabled to get her living. This case is figured in Photograph No. 1, Illustration 21.* But although osseous consolidation does not always ensue, yet when it does it affords the very best mode of union which can be obtained. So strong indeed is the junction which, under these circumstances, obtains, that it becomes even more resisting and stronger than the shafts of the long bones. Ried has quoted the post-mortem examination he made of one of Jœger's cases of excision of the knee-joint fourteen years after operation, the patient dying of pulmonary consumption, and states:—"That the ends of the femur and tibia were firmly united by bony union, with displacement transversely, and partial rotation on each other. A few years before his death he fell off a ladder and broke his fibula in the lower third. Thus it seems that the union at the knee was firm enough to resist the force which caused this fracture." †

In children, as before observed, I believe that the union which results is not only fibrous and flexible immediately after recovery, but continues so for some considerable time. Thus, in a thigh which was amputated by Mr. Jones, of Jersey, on account of caries of the femur and tibia, about nine months after excision of the knee-joint, it was found that the femur and tibia were united by "strong ligamentous union."‡ Again, in one of my own cases of excision of this joint I amputated two years and three months subsequently, and found the femur and tibia carious, and merely united together by tense fibrous tissue which extended between the circumferences of the bones.

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* This drawing is omitted.—H. S.

† On the Process of Repair after Resection and Extirpation of Bones. By Dr. Albrecht Wagner. Translated by T. Holmes, M.A. 1859.

‡ *Medical Times and Gazette.* 1855. Vol. ii. p. 342.

I have come to the conclusion that the existence and progress of caries and necrosis very frequently prevent the formation of osseous union. Callus, as before observed, is not always generated; and when it is, I imagine, it is only under the most favourable circumstances.

But a fibro-osseous anchylosis is a frequent result, and one which depends on such causes, as before mentioned, when speaking of the agencies which more or less control the formation of true callus. Thus, in the Museum of St. Thomas's Hospital there is a preparation furnished by a patient whose knee-joint was excised by Mr. South, exhibiting this form of union. It consists of the ends of the femur and tibia and patella, and shows *tolerably* perfect bony anchylosis between the two bones, there being only a very slight and obscure movement between them. "The remaining uniting medium (which is of very small extent) consists of a fibrous material; there is no cartilage."

From the observations of Chaussier, and those of Wachter, Klencke, Heine, Vermandois, Syme, and others, it appears that from experiments on animals, the repair which ensues after excision of the various joints depends upon various circumstances. Thus, while in the hip the result of removing the head of the femur is, in general, highly advantageous, the operation of excision of the ends of the tibia and femur is not so. "For instead of forming a new joint the ends of the bones rode on each other, and were united to each other by ligamentous material, so that the limb below the joint was pendulous, and quite useless for motion."*

This same result, which occurs in the excisions of joints in animals, is also apt to follow a similar proceeding on the knee of a young child, and, perchance, on that of an adult. The specimen from my own collection to which I have already alluded illustrates this result; but I believe greater attention paid to the mechanical treatment of the limb will, in a great measure, tend to prevent this unfortunate termination of so good an operation.

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* Op. cit., p. 143.

If the parts be examined some time after excision of the knee-joint—those parts of the bones which are intended to coalesce—it will occasionally be found that a considerable amount of new bone has been deposited on their circumferences, and, if the patella be left, on it also. There are also changes which ensue in the surfaces and cancellous structure, which are, however, dependent on circumstances. Should caries and necrosis attack the ends of bone, it is probable that the end of the femur, although the saw may have been applied through the condyles, will very greatly alter in shape, and assume a mere rounded aspect. This is well exemplified in the preparation of the limb amputated two years and three months after excision. The tibia also may undergo the same degenerative processes, and merely exist in a wedge-shaped condition. Undoubtedly the tendency of the cut surfaces, provided they be not maintained in position by suitable anchylosis, is to degenerate and alter in form, so that even ultimate success is spoilt thereby.

It was thought by the late Dr. Mackenzie, that the cause of non-development of the limb after excision of the knee-joint in children, was to be accounted for on the ground that anchylosis of an osseous character did not always take place. Such an opinion has lately been found incorrect, although the non-existence of osseous consolidation doubtless does, in a measure, favour the mechanical and physiological alterations which sometimes ensue.

Anchylosis, even when diligently sought for, is a natural and not, as too many are inclined to believe, an artificial process. The surgeon can, however, do much by maintaining the due amount of rest, and keeping the parts firmly and quietly in apposition. By the exhibition of certain medicines he may also, perchance, influence the character of the necessary union; but, further than this, I do not think he can "bring about anchylosis."

Of the utility of the limb after excision, I have yet to say a few words. From all that has been stated, I think that those surgeons obnoxious to the operation of excision of the knee-joint must admit, that if not always, at least very commonly, the limb which results after removal of the articulation is a useful member, and one in every way better than a wooden substitute. But I know it is difficult for patients who are charmed with the result of an operation of this character even to make some surgeons rightly comprehend their satisfaction; and, therefore, whatever commendations others may bestow must seem, indeed, like idle tales. But to the right thinking surgeon, success in this proceeding must be highly gratifying, but more especially to those who have fought the good cause against prejudice and ignorance. I now never see a patient who has had a knee-joint excised without putting a question regarding the utility of the limb, and if he regards his altered member superior to an artificial support. The answer in every case, without a single exception, has been of a kind most highly gratifying to the surgeon who struck from the beaten path, and secured to him who sought his advice and counsel a useful limb. But it may be asked, Is a limb which results after removal of the knee-joint useful as a means of progression, &c.? I answer that every limb is not, and, I think, I have already stated the reasons why it is not so. But can any subsequent means be adopted whereby a limb, *minus* the knee-joint, can be made useful? In some instances I unhesitatingly say, "Yes." Within the past few weeks Mr. Hancock has had in hospital a case in which removal of the knee-joint was most successful. The patient left the hospital quite well, but has again returned complaining of the limb which was operated on. Mr. Hancock, suspecting that caries or necrosis was gaining ground, opened up a sinus which existed, and took away from the back of the femur such portions as were included in the mischief. Mr. Fergusson, in a case which had shortly before been operated upon by an able practitioner in the north of England (Mr. King), re-exsected the ends of the tibia and femur which had formed a false joint, in the hopes that by readjusting the cut surfaces a good result might ensue. The ends of the tibia and femur thus removed are represented in a cast accompanying some preparations.*

Regarding such a proceeding as this, there may be different opinions; but having seen the case prior to operation, and the operation itself, together with the result, I am sure that no practical surgeon will deny its propriety and great advantage.

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* After all, the utility of the limb, after its preservation by the surgeon, is the great point to be effected—not only in excision of the knee, but in the instance of excision of the hip and elbow; and if it were found by experience that only an incumbrance were left for the patient after all the danger and trouble had been incurred, it would be folly for any one, however conservative his feelings may be in this direction, to adopt this operation. The author has had very good opportunities of showing that very serviceable limbs are preserved in the majority of cases, and since he wrote these remarks we have had much additional opportunity of forming a correct opinion on this matter. I must confess I have been astonished and delighted with the condition of the limb in some of the cases, especially in those instances where the operation has been performed upon adults, or upon young persons whose growth had been nearly completed. In several of the cases where Mr. Fergusson operated, the patients are in the habit of visiting our hospital, and the well-formed, useful limb is an object of admiration; and the patients express themselves as not only satisfied, but highly pleased with it. In some of the cases there is scarcely any shortening whatever, and not even a stick is required; in some of the instances, however, there has been a sufficient amount of shortening, or deformity, to necessitate not only the use of a stick, but the employment of some artificial apparatus, so as to form a support; but, curiously enough, the patient is enabled to move about with much greater facility than if he had a wooden leg. I have not as yet, in a sufficiently advanced case, seen an instance where the uselessness of the limb, referred to by Mr. Syme and others, has existed, although I can readily believe that there would be almost an entire arrest of growth if the epiphyseal ends of the bones were wholly cut away in a child; but it is clear that this need rarely be done.

Whilst referring to this point, I with pleasure call attention to the result of one of my own cases, where the operation was performed for bony anchylosis, the result of a gunshot wound through the joint, on a fine Guardsman, in September 1862. A large bony wedge was taken away, and the limb was brought straight: the patient did remarkably well, and was dismissed from the hospital with a straight limb, only two inches shorter than its fellow. I had a letter from the man exactly one year after the operation, and the following is his own story :—" My limb is all that could be desired. I have walked many a long journey with it, with nothing but a walking-stick as an assistant. I can walk three miles an hour with perfect ease. I wear one inch of cork in the inside of my boot, which makes up all the deficiency in length. My knee is quite tight and firm at the joint."—H. S.

It may be, I admit, followed with such a result as, in the estimation of some, might be constituted a failure; still I am one who greatly abets and approves of conservative measures which have for their aim the preservation of the human body, and especially when such conservatism is followed by results gratifying to the surgeon and highly advantageous to the patient.

PART IV.

In the foregoing pages have been considered those various diseased conditions, including abnormalities arising therefrom, and accidents which necessitate the adoption of direct and important surgical interference. It has, moreover, been shown that the majority of these several affections may, when proving rebellious to all milder means of treatment, be more or less successfully treated by excision of such structures as are involved in disease. Having, therefore, pointed out all such abnormal conditions of the various component joint structures which, under certain conditions, demand removal by the knife, it will be needless to recapitulate them; and I shall, therefore, at once proceed to the consideration of those cases in which the knee-joint is the seat of disease, which can, with the greatest amount of hope and success, be treated by amputation when other measures have been found wanting. And here I may repeat what I have stated in a former part of this Essay, viz., that I am of opinion, and that opinion is founded on experience and a knowledge gained from facts, there is scarcely a single phase of disease attacking the knee-joint which necessitates direct removal by the knife,* which may not be most judiciously treated in the young and middle-aged subject by excision in preference to amputation, provided that certain plain and palpable indications do not contra-indicate it. I have only claimed one exception to this opinion, and that is permission to withdraw from the list of joint diseases that form of tuberculous invasion which has its seat in the cancellous structure of the ends of the long bones, and is *unlimited* in its ravages—that form which I have designated " diffuse infiltration."

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* It is scarcely needful to mention that I have not included in this observation malignant diseases of the articulation, &c. &c.

But before proceeding further with the consideration of the subject, it may be advantageous to inquire, how is it—experience teaching—that the majority of joint affections directly confined to the articulation, although amenable to the more conservative operation, are very generally treated by amputation? Will statistics—reliable data—of any great number of unsuccessful cases, and the causes which rendered them so, inform the inquirer of the reason? No. The reason must be sought for in other channels. How is it that the surgical staffs of large hospitals, year by year, continue to amputate through the thigh for disease of the knee-joint, without even trying the operation of excision of the articulation? How is it the operation is condemned, to the manifest disadvantages of numerous poor and sick people, to whom the preservation of a limb is of the very highest import? Is it because the proceeding has had a fair trial and been found wanting? I think not. On looking back to the table of cases of excision of the knee-joint which I have elsewhere given, it will be found that the 238 cases which were operated upon in civil practice in Great Britain and Ireland, and also in Jersey, were performed during a period of ten years* by only ninety-three practitioners; and that of these surgeons fifty-one performed the operation only once, while eighty-eight operations were undertaken by seven operators,† four of these being London hospital

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* From 1850 to 1860, inclusive.

† Viz.:—

Mr. Fergusson	21
Mr. Humphry	18
Mr. Jones, of Jersey	19
Mr. Erichsen	10
Mr. Pemberton	7
"Spero" (Mr. Price)	7
Mr. South	6
Total	88

surgeons. These statistics will, therefore, I think, show that as yet excision of this special joint has not met with the practical consideration it deserves. But to limit the argument of the separate advantages and disadvantages which result from the performance of excision and amputation for the relief and cure of certain diseased conditions of the knee-joint, it will be necessary at once to review the results of amputation for such diseases of the knee-joint as were treated, as described in the aforementioned tables, by excision.

But, although I have been at some considerable pains to ascertain all particulars relating to the 291 cases I have quoted, and to tabulate the results, still it must not be presumed that I put very great faith in statistics, even very carefully compiled. There are various circumstances connected with many of these cases which place them beyond the pale of statistical value; and I wish to insist on this point, because I am unwilling that a great operation of this kind should be valued, and spoken for or against, simply from the dry results of statistical information. Yet I know some may even wonder why I should object to have the statistics of excision of the knee-joint placed side by side with those of amputation through the thigh. Far from raising an objection to a comparison of this kind, I am anxious that the two operations should be so judged; for it will be seen that excision of the knee-joint, when judiciously employed, is a proceeding creditable to the surgeon and beneficial to the patient.

Perhaps the most common cause which necessitates amputation through the thigh in civil practice, is chronic disease of the knee-joint; and on looking for various statistics, there will be no difficulty in classifying the operations which were undertaken on this account. As the statistics relating to excision of the knee-joint have been taken indiscriminately, it will, therefore, be advisable to collect those of amputation through the thigh in the same way.

Dr. Julius Paul, in his excellent work, entitled "Die conservative Chirurgie der Glieder, &c." (Breslau, 1854), gives statistics of 1003 cases of amputation through the thigh, collected from the practice of many of the most able men, not only of his country, but of Europe and America. Of these 1003 cases, 454 died, or nearly one-half—2·2. These operations were all performed during the period when excision of the knee-joint was in its infancy, and it is only right to infer that a master hand was at work on each case. But it may be argued, that it is not quite fair to take so large a number of cases when the statistics of excision are drawn from only about a third of the quantity; and perhaps not. Let us examine more closely into individual practice.

Jœger, who has written ably on excision of the knee-joint,* gives a summary of twenty-three cases of amputation of the thigh, performed from 1827 to 1835, of which ten died, or a fraction less than half.

Benedikt publishes, from 1842 to 1852, a list of thirty-six cases of amputation through the thigh, of which eleven died, or something less than a third of the number.

Chelius, however, appears to have been much more fortunate in his practice, for, out of ten cases in three years, he lost but one.† But to turn to the results of amputations performed elsewhere.

The most valuable statistics which are to be obtained, regarding the mortality of amputation through the thigh, are from the pen of M. Malgaigne, who states that in 201 cases 129 died,‡ or about two cases proved fatal out of every three; or, *entirely* for disease, 153 cases and 92 fatal. In the Hôtel Dieu, between the years 1841 and 1842, M. Roux amputated through the thigh on sixteen occasions, and only seven cases were attended with success.§

Dupuytren, who possessed the most cunning handicraft, in eleven operations of amputations through the thigh, lost nine cases; certainly an enormous mortality.||

From these few statistics it will at once be apparent, that amputation through the thigh, even in the hands of the most

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* Op. cit.

† Klin. Annal. I., 1.

‡ Etudes statistiques, etc., Archiv. génér. de Méd. Avril 1842.

§ Résumé stat. de la clin. Chir. de l'Hôtel Dieu. 1842.

|| Leçons orales, etc.

able surgeons, is a most fatal operation. But as the statistics I have offered regarding excision of the knee have mainly been taken from English practice, it is only right that the results of amputation of the thigh should likewise be collected from similar sources.

Let us turn for a time then, and consider the results of some of our English hospital practice. In the year 1840 the late lamented Dr. Laurie published a most interesting paper "On the Results of Amputation."* Of ninety-two amputations of the thigh for disease, as performed in the Glasgow Infirmary, seventy-three were cured and nineteen died, or one case in nearly three four-fifths.

Between the years 1835 and 1840 Mr. South performed, at St. Thomas's Hospital, thirteen amputations through the thigh for disease of the knee-joint (scrofulous), and four died, showing an average of about one in three cases.†

Mr. Liston, prior to 1841, had performed, at University College Hospital, eight amputations of the thigh for disease of the knee-joint, with only one death.‡

In forty-six cases of disease of the thigh (knee-joint ?) which were submitted to amputation, nine died, showing one death in five cases.§ These operations were performed at University College Hospital.

Mr. Hussey, in fifty-five amputations through the thigh on account of disease, lost ten patients, showing one death in about five cases.||

Mr. James, of Exeter, out of 119 cases of amputation of the thigh, lost only ten, showing the very low rate of mortality of about one in twelve cases.¶

In the *Medical Times and Gazette* for 1856 and part of 1857, there are recorded fifty-four cases of amputation through the thigh for disease of the knee-joint: of these forty-five

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* *London Medical Gazette*, vol. xxii. p. 457. 1838.

† South's Translation of Chelius, vol. ii. p. 905.

‡ Medico-Chirurgical Transactions, vol. xxiv. 1841.

§ Science and Art of Surgery. 2nd edition. By J. Erichsen. 1858.

|| Medico-Chirurg. Trans. 1856.

¶ *Medical Times and Gazette*, November 1, 1856.

recovered and nine died,* showing one death in every five cases.

Out of ninety-two cases of amputation of the thigh performed in Addenbrooke's Hospital, seventeen cases proved fatal, or about one in every five and a half cases.†

In a report of twelve cases of amputation of the thigh performed in St. George's Hospital during a part of 1856, six died,—exactly one half.‡

Mr. Teale, in the year 1858, collected the statistics of amputation of the thigh for disease of the joint (knee), and found that during a period of three years—from July 1st, 1854, to July 1st, 1857—in the London hospitals, there had been 169 amputations, out of which number thirty-eight died, or about one in every four and a half cases.

In the provinces the result was a trifle more favourable; for during a period of three years, 134 amputations were performed for disease of the joint, &c., and thirty-three died, or about one in four cases.§

Mr. Bryant, of Guy's Hospital, has made the mortality arising after amputation of the thigh for disease of joints, not higher than one in seven cases.||

From these various statistics it will be seen that amputation of the thigh, even for disease, is a most uncertain operation; and that, although it may sometimes be devoid of such an amount of danger as many would make believe, still, I believe, even in the most skilful hands, it is often highly unsatisfactory. It is quite impossible to draw correct and available deductions from these various quotations, but I am induced to look upon amputation of this member for chronic disease of the knee-joint as fatal in about one case in four. It may be more and may be less, and some practitioners may be more successful than others, which they are undoubtedly; but still, I think,

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* The Mortality after Operations of Amputation, &c. By A. E. Sanson. 1859.

† Medico-Chirurg. Trans., vol. xli. p. 211.

‡ *Medical Times and Gazette.* 1856.

§ Teale on Amputation, &c. 1858.

|| Medico-Chirurg. Trans. 1860.

I am not far wrong in my calculations, especially if a large number of instances be collected, carefully sifted, and arranged.

Admitting, then, such is about the average mortality after amputation for disease of the knee-joint, it becomes a question, the mortality after the two operations of excision and amputation being about the same, which is the more favourable and advantageous proceeding to adopt? To the general observer there can be no doubt whatever, but to the surgeon there seems to be an immense difficulty to decide. But if results of statistics do not satisfy the incredulous, certainly a critical investigation into the causes of death after these two great operations will do. If we look down a statistical column indicating the results of amputation in a large number of cases, our gaze will soon be arrested with such unfortunate remarks as the following:—"Secondary hæmorrhage," "sloughing of the flaps," "extreme suppuration," &c.,—causes of prolonged recovery, if not of death, which are not, as a rule, or if ever, to be seen down the columns notifying the results of excisions of the knee-joint. Then, again, there is the great shock to the system by the division of large vascular channels and nervous tracks, and, perhaps, the loss of a large quantity of blood. In addition, there is the well known shock to the constitution, independent of loss of blood; a condition out of which the patient does not always recover, although the case was favourable for the operation, and the surgeon a skilful operator. These are results which we do not often expect to see follow excision of the knee, although I do not deny that shock very materially influences the condition of a patient after removal of the articulation, and that, occasionally, secondary hæmorrhage may prove dangerous, as it did in two instances which I have already quoted.

But in attempting to draw a comparison between amputation of the thigh and excision of the knee-joint for disease of the articulation, it must be borne in mind that there are various extraneous circumstances which exert a decided influence on the comparative estimation of the value of the two operations, as far as can be gleaned by statistics. It is to be recollected that while the subject of amputation has had bestowed on it the best attention of some of the first surgeons Europe has produced, during a period of many hundred of years, excision of the knee-joint is an operation which has only been practically considered by a very small minority of the surgeons of this present generation. Many of these surgeons have, as I have before remarked, only once tried the proceeding, and, therefore, can know but little about its value, its difficulties, and its drawbacks. It has also been stated how, in the earliest years of its trial, its performance was adopted as a *dernier ressort*, and the cases were very improperly selected. It has, moreover, been proved that, even in later times, a lamentable want of skill and tact has been found wanting on the part of the surgeon, so far as the daily and mechanical management of the patient and limb were concerned. Fatal results have followed, owing entirely to bad and indifferent treatment, just as unfortunate terminations may follow bad cases of compound fracture, owing to the incapacity of the surgeon to keep the apposed surfaces of bone at absolute rest.

Of all obstacles, as I have previously stated, which have been thrown in the way of the operation of excision becoming a recognised proceeding in hospital practice, there are none which have taken a greater hold of the profession than that urged by many, viz. "That for the complete success of the operation of excision of the knee-joint, a very considerable period of time is needed." Now, such an objection as this I have, I think, shown cannot for one moment hold good. I maintain that, for the complete success of an amputation, an equivalent amount of time is often necessitated. A period of two months is not thought too long for an amputation case to remain in hospital, when any complication (abscess, or secondary hæmorrhage, for instance) has resulted. I have had unusual opportunities of observing the results of amputation at the ankle-joint; and I can affirm that, as a rule, the stump which results is of little avail, as a support, for periods much longer than are generally imagined. Then, again, take the time that is necessary for some plastic operations to prove successful, and the long interval which must often elapse ere a compound fracture in the neighbourhood of a joint is satisfactorily united; and yet the surgeon never murmurs provided he cures his cases!

Without prolonging further these various observations, which have been intended to embrace all the requirements of the subject of this Essay, I will at once proceed to state, in a brief but comprehensive manner, the results of my arguments and deductions.

I am of opinion that all diseases of the human knee-joint, not of a malignant character,—confined entirely, or almost so, to the articulation,—can, with but few exceptions, be treated as efficaciously, or even more so, by excision as by amputation through the thigh.

With regard to the exceptions, I think there is only occasion to exclude two,—viz., diffuse strumous infiltrations of the cancellous structures of the articulating bones, and acute inflammatory (purulent) conditions of the various joint components. That the more chronic the mischief, the more advantageous is the case for excision. That the operation of excision is of value at all ages, as far as experience has shown, viz., from three and a half years to fifty-five years; but that in its performance on young children certain disappointments are liable to be encountered, if due regard be not paid to the preservation of the developing portions of the articular ends of the long bones forming the joint.

That the time necessitated for the success of the operation is not, when the treatment is successfully managed, of longer duration than that required for the recovery of other operations of magnitude, or for severe injuries, as compound fractures, &c. &c.

That the limb which results, no matter how much shorter or disproportioned, is far better than a stump, no matter how beautifully contrived, and a mechanical support, however cleverly constructed.

That the dangers of the operation of excision of the joint are less, as a general rule, than those which are apt to occur after amputation through the thigh, no matter what manner of proceeding is adopted.

That the statistics of excision of the knee-joint, as collected by myself, may be considered quite as favourable, if not more so, than those which can be gathered from sources as various and promiscuous. That the proportion of deaths in all the cases, 291, which I have tabulated, is 78, and the proportion of unsuccessful cases is 1 in every 3·7.

That the statistics of amputation through the thigh so greatly vary, that it is impossible to collect cases which would definitely settle the average of fatal results; but that, in all probability, the average mortality is about 1 in every 3·5, or 1 in every 4·5, or, perchance, 1 in every 5. Only in isolated practices can a higher average be obtained.

That in 238 cases of excision of the knee-joint performed during the ten years from 1850 to 1860 inclusive, in this country and in Jersey, the number of deaths have been 55, giving a proportion of 1 in every 4·3 cases.

That amputation was needed in 30 cases, 5 of which were unsuccessful, showing a mortality of 1 in 6 cases.

That amputation was not always wisely resorted to, and that its necessity was not unfrequently demanded by the incapacity of the surgeon.

That the more frequently this operation is performed, with due attention to all the points I have insisted on, the more successful will be its results, and the less frequent will be the resort to amputation, which, under certain circumstances, earns its by no means envious title, "The opprobrium of surgery."

That in cases of deformity, without the existence of disease, when milder means have failed, excision is an operation far more favourable than amputation.

That, as far as experience teaches, two cases only having been submitted to the operation,* excision for fractures, and dislocations in the neighbourhood of the knee-joint, when operative measures are necessitated, is a judicious proceeding.

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* I do not include here White's case, in which he removed the condyles of the femur in a case of injury to the knee, or cases under the care of Mr. Simon and Mr. Spence.

That as yet no determination can be come to regarding the adoption of excision of the joint for gunshot wounds, and injuries received in battle; two cases, both fatal, only having occurred. And

Lastly.—That, in my own opinion, not only do I consider it the bounden duty of all surgeons to give a fair trial to an operation which it has been my humble endeavour to place on a correct footing in the foregoing pages, but to do all in their power to improve the various features connected with it, so that its already good results may be improved, and its still more successful performance may, to borrow an expression from the great Ambrose Paré, redound "To the honour and glory of Surgery."

APPENDIX.

Case 1.—Sarah P., æt. 15, a slim pale-faced girl, somewhat dwarfed in growth, had suffered for five years with strumous disease of her left knee-joint.

The following account I take from my note-book:—

"She is a native of London, and has been but indifferently nourished; and, at the time of her admission into the hospital at Margate, was in an extremely emaciated condition. Having improved through a liberal diet and good sea air, but the local affection continuing, it was determined to excise the decayed joint.

"At the time the operation was decided on, the joint presented the following condition:—

"The leg, which is somewhat emaciated and flabby from disease, is flexed at a right angle (but, perhaps, one rather more obtuse) with the thigh. The joint is greatly swollen, and its proportions much altered. This enlargement is principally owing to a highly elastic state of the swelling, which extends on each side of the patella, and upwards under the rectus. The integument covering the joint is white and glistening, except at certain points, where fistulous openings exist, of a darkish brown hue, and admit the passage of a small probe into the interior of the head of the tibia, and into the interior of the joint. These tracks are more or less tortuous in their passage, and communicate with each other. An offensive discharge escapes through these orifices. The femoral condyles are not enlarged, but the head, although not really expanded, has the appearance of being so, from the thickened and indurated condition of its covering tissues. Moderate pressure causes but slight annoyance, but when increased gives a painful gnawing sensation. There is no dislocation of the head of the tibia, but the head is filled with disease. The hamstring tendons are much contracted. Great pain at night causes sleeplessness. The patella is in its right position, but firmly fixed."

On 17th May, 1856, the joint was excised; an H-shaped incision being used. The head of the tibia was found excavated by three large cheesy masses like abscesses. The femoral condyles were in the same condition. An inch was taken from the femur; and subsequently another slice, three-quarters of an inch, was sawn off the head of the tibia, and the patella removed. The synovial membrane was greatly diseased, and the cartilages gone.

A rapid recovery took place, and the limb was treated in the splint which is figured (No. 2, Illustration 20).* In a few weeks this patient was up, although the ends of the bones, which were well in position, were tied together only by soft material.

A photograph (No. 4, Illustration 22) represents the case some time (one year) after operation. A useful limb was obtained, and I lost sight of the patient till December 1860, when her condition was, as is represented in No. 5 (Illustration 22) photograph.

It will be seen that considerable shortening exists, and that fistulous openings are scattered over the front surface of the femur, evidently leading to decayed bone.

The girl, however, has a useful limb.

The conditions presented by the portion of bones are aptly portrayed in Plate 2.

Case 2.—In this case excision of the joint was performed for disease of four years' standing, but it unfortunately terminated in amputation, although the patient made a good recovery.

J. F., æt. 9, was sent to the Children's Hospital at Margate, in the summer of 1856, much out of health, and with a joint much diseased. The case was deemed one in which excision would prove the correct treatment, as a capital operation was earnestly demanded.

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* This and the next two illustrations are omitted.—H. S.

The following is the condition presented by the joint at the time of operation:—" The joint is much swollen, but the swelling is well defined. The integuments are stretched, and have a white, glassy appearance; the superficial veins are loaded with dark-coloured blood. Intense pain is caused when the swelling is handled. The enlargement is confined principally to the front of the joint. There is distinct evidence of pus in the articulation. The leg is semiflexed on to the thigh. The lad's health is greatly shaken, and he suffers all the symptoms of ulceration of cartilages, &c."

The operation was performed 28th July, 1856, under chloroform. The joint was opened by an H-shaped incision. The synovial membrane was of a dark purplish hue, increased in thickness, and gelatinaform in consistence. The cartilage was eaten away both from the femoral and tibial portions of the bones. The crucial ligaments were healthy, but the inter-articular cartilages were quite gone. The patella, ulcerated on its inner surface, was taken away.

The limb, placed on the splint described in the last case, was carefully watched. Much more disturbance followed than in the previous example. Considerable trouble was given by this patient, but at the end of a month he was in every way greatly improved. But things did not progress: although the cut margins of the wounds healed, still sinuses existed, and abscesses continued to form. The lad never properly recovered, although he was able to get about with the aid of a stick or crutch. On three separate occasions, during the space of two years, I placed him under chloroform, and searched for carious bone, which I suspected to be present, and each time removed some portions. But with all care and attention bony union would not result: the limb was useless, and had little power. The swelling was considerable about the *new* joint, and the pain sometimes excessive. Under these circumstances, after the lapse of two years and three months, I considered it useless longer to delay amputation, and accordingly removed the thigh at its lower third; the child soon improved in condition and regained flesh. At the present time, December 1860, he has a solid useful stump.

The condition which the limb assumed some two years after operation, is represented by Photograph No. 3, Illustration 22.*

From the condition in which I found the bones at the time of operation—for they were soft, vascular, and unhealthy-looking—I concluded that the case was not so favourable for excision as that just recorded; but still, as Dr. Keith did, I hoped for the best, not knowing then, that diffuse inflammatory conditions of the ends of the bones in a strumous individual were unsuited to the success and application of the operation.

Case 3.—In 1856 (Oct. 15th) I operated on a young woman at Margate, who for several years had laboured under disease of the left knee-joint. At the time she was sent to the hospital, chronic disease of the articulation had greatly reduced her; and instead of improving under the influence of a liberal diet and good air, the limb got worse, and assumed more acute mischief. With the accession of the local disturbance, the health began seriously to decline; and finding that removal of the implicated joint was imperative, and looking on the disease as one originally of synovial character, but now extended to the cartilages and bones, I determined to adopt excision in preference to amputation. This was requested also on the part of the patient. On cutting into the articulation, a quantity of pus escaped, and lying at the back surface of the femur was a large sequestrum. The synovial membrane was almost entirely destroyed, the articular cartilages quite removed, and the ligaments in a pulpy state. Two inches or more altogether of the bones were taken away, the limb was placed in the usual splint, and in six weeks the patient made a good recovery. Abscesses, however, continued to form, which greatly annoyed the patient; and as it was thought that this might originate from disease of the patella, which had been left, chloroform was administered, and the bone, which was found bared and necrotic, removed. With the removal of the patella, all abscesses and sinuses healed, and the patient made a rapid and complete recovery, the bones being united by means of osseous material.

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* This illustration is omitted.

Photograph* gives a correct idea of the length and soundness of the limb.

The woman is now earning her livelihood.

Case 4.—In October 1855, a patient was under my care, a girl, æt. 15, in the Children's Infirmary at Margate, on account of chronic disease of the right knee-joint. The disease remained dormant for some time, but in 1857 it recommenced, owing to an accident. An acute attack of inflammation followed, which resulted in abscess of the joint. Great pain and prostration followed this unfortunate attack, and the formation of a fistulous track enabled a probe to be passed into the articulation, which was discovered to be disorganized. Feeling assured that the joint was permanently damaged, and that to save life a capital operation was necessary, I determined to excise the articulation in preference to amputating the thigh. This was done December 7th, 1857. The joint was opened by a semilunar incision, and the chief mischief was found to be in the back portions of the femur—in fact, a large abscess involved the bone. This was cleared out by means of the gouge, and a certain portion of the condyles cut away by the saw. No disease implicated the head of the tibia, and the cartilage covering it was, therefore, only just taken away.

The patient made a most excellent recovery, firm osseous union eventually consolidating the bones. There was but little constitutional disturbance after the operation; the splint was not touched (changed) for seven weeks, when it was altogether removed, and for it was substituted a support of gutta-percha.

Cast No. 1, and Photograph 2, Illustration No. 22 (taken shortly after the operation), show the excellent result which followed.

This patient has, at the present time, a most useful limb,

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* This illustration and the next are omitted.—H. S.

—certainly one of the best I have seen. Three years have elapsed, and she can walk well with the leg; she is under-nurse at the hospital at the present time. The shortening is by no means considerable, and the result is all that I could desire.

Case 5.—On November 18th, 1857, was admitted under my care, in the Great Northern Hospital, a lad, æt. 19, who in infancy had suffered from disease of the left knee-joint, which had resulted in anchylosis, the tibia being tied to the femur at a right angle. The patient was anxious that, if possible, a useful limb should be given to him. The case being apparently one well suited to the adoption of excision of the joint, I advised that it should be performed: the patient consented, and on November 20th, 1857, the limb was placed in a straight position, the entire joint being taken away. Prior to operation the following particulars were noted in regard to the condition of the parts forming the joint:—"The tibia is dislocated behind the condyles of the femur into the popliteal space, and firmly anchylosed by apparently bony union. The leg is fixed at a complete rectangle to the thigh. The patella is firmly fixed to the front of the condyles. The hamstrung tendons are tight. The scar of sinuses denotes the existence of previous mischief. The thigh, compared with its fellow, is remarkably small. The leg and foot are also inferior in size to the corresponding members, but the bones of the leg are well covered, and possess evidence of considerable usefulness. Measurements make the affected limb about an inch and a half shorter than the healthy one."

On the above-mentioned date, the portions of bone shown in Preparation No. 2* were removed in a block, and the limb brought quite into the straight position. The operation was one of difficulty, but was accomplished to my satisfaction, as little blood was lost, and the patient did not seem much distressed some hours afterwards. The case progressed well, but, unfortunately, in about a fortnight he was seized with

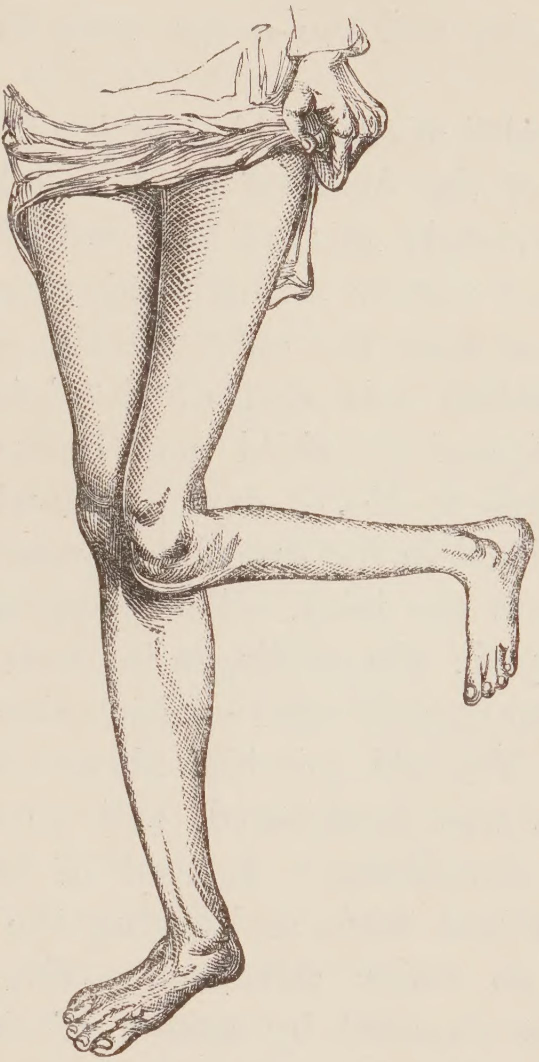
* This preparation was sent in with the Essay.—H. S.

an attack of pleuro-pneumonia, which terminated unfavourably on December 20th, 1860.

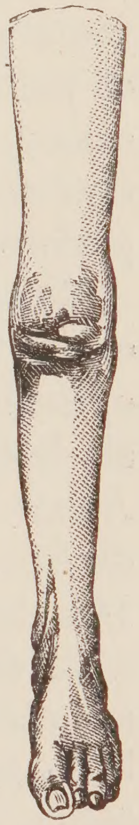
I had great cause to regret the ill-success of this operation, for in every respect it appeared one to which the operation of excision was well suited.

The annexed Plate, No. 1, gives a very correct idea of the limb before excision, and No. 2 shows the position (from a cast) in which the leg was placed at the time of decease. The thickened state of the limb is owing to induration and swelling of the tissues which preceded death.

Should another case similar to this come under my observation, I should have no hesitation in adopting a similar operation, as I consider the unfortunate result might have arisen from amputation, or even a less formidable proceeding.*



No. 1.



No 2.

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* It may be a question even with those who are the strongest advocates of excision of the knee-joint for disease, whether so severe a proceeding is justifiable for remedying deformity as in the case just related. I think that if the deformity of the limb be so great that it is only a burden to the patient, and he be determined to lose it by amputation or by excision, that the latter operation is perfectly justifiable; in fact, after what I have seen of this operation for such cases, I could not conscientiously amputate a limb possessing a well formed leg and foot merely because it is deformed at the knee. It is true that there must be some considerable risk to life, but nearly the same danger will be incurred if resort be had to amputation; and then should the patient recover he has not his own leg and foot. I know very well that a strong feeling has been expressed when a death has occurred after excision for the removal of deformity, and this feeling is a natural and commendable one.

Case 6.—In the summer of 1858, at the Children's Hospital at Margate, I removed the knee-joint of a child who for years had suffered from chronic disease of the joint. The deformity in this case, and the condition of the parts, are seen in Cast No. 2.* The integument covering the articulation was riddled with sinuses, and the bones were firmly fixed at an obtuse angle.

The health of the child, a girl, æt. 12, was shaken, and the removal of the diseased joint was highly desirable. Some years previously she had been troubled with a continual flow of purulent matter through the rectum: this, however, had ceased, and now the only affection which prevented restoration to health was that of the joint. The operation was performed, and the child went on favourably.

Reference to No. 3 dry preparation shows that a large cavity existed in the cancellous structure of the femur which opened into the joint. The synovial membrane was nearly all destroyed; the cartilages in parts were likewise removed. About two months after excision the little patient began to decline. The old mischief about the bowels was re-ignited. Diarrhœa was established, and purulent matter was mixed with the excretions. Instead of improving she gradually emaciated and sank, and during the time it was noticed that little or no union advanced. Eventually, the end of the femur was exposed by reason of the covering integument sloughing. After death† I removed the limb, and the parts immediately concerned in the operation of excision are preserved in Preparation No. 2 (moist).‡

It will be seen that the protruding portion of the femur is soft, and dead.

Had this patient not been seized with the abscess some-

At the same time we must not shut our eyes to the fact that amputation has in numerous cases been resorted to merely for the purpose of removing a distorted limb, that death has occurred, and that no one has ever thought of casting blame upon the surgeon for performing what was supposed to be a very justifiable operation.—H. S.

* This cast with the preparation was sent in with the Essay.—H. S.

† Death occurred July 1st, 1859.

‡ This preparation was sent in with the Essay.—H. S.

where about the intestines (no post-mortem was allowed), I have every reason to believe that the case would have succeeded.

Case 7.—On the 1st of June, 1859, was admitted into the Great Northern Hospital a man, æt. 26, a labourer. He had been subject to chronic inflammations of his left knee-joint for years. The original mischief commenced four years prior to this date. In September 1858 he received an injury to the joint, and since that period he has been more or less subject to symptoms which indicate synovial degeneration, ulceration of the articular cartilages, and exposure of the bone.

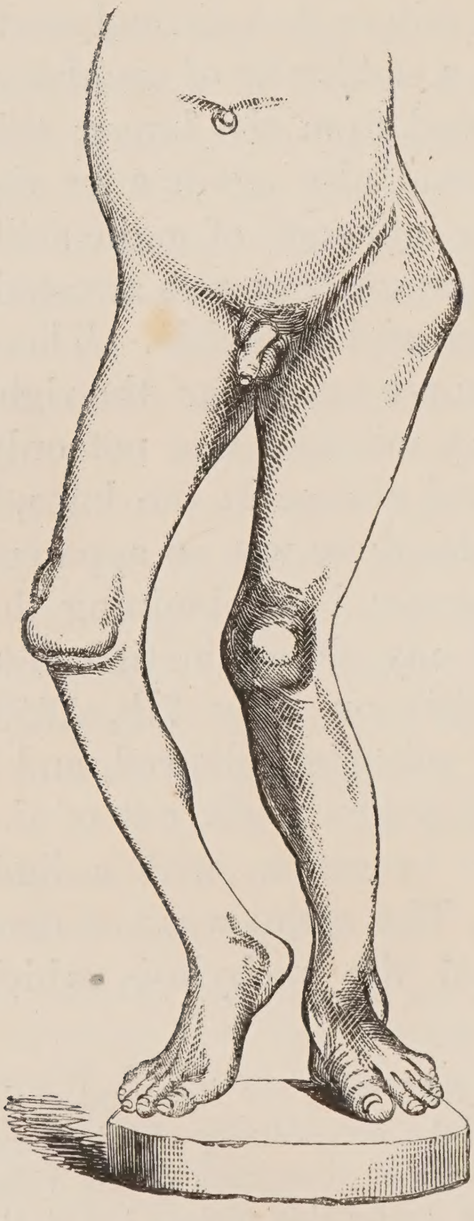
Eleven days after admission, while actual cauteries, blisters, &c. &c., were being tried, in vain, to relieve the pain and startings of the limb, he was seized with a sudden fit of coughing, and brought up a few ounces of blood from the lungs; this was repeated on the following day, and also again after the interval of three days. Under the influence of gallic acid, with sulphuric acid and opium, the hæmorrhage was arrested. Crepitation was detected beneath the right clavicle. There was, also, marked dulness over the upper portion of the right lung. Believing that the pulmonary mischief was not only kept up, but accelerated by the local disease in the knee, I determined to excise the joint. To this there was an apparent objection on the part of my colleagues; but, obtaining the consent of my patient, I carried my determination into practice, and excised the articulation on July 7th, 1859. Immediate relief to the pulmonary mischief followed, and I had the great pleasure of seeing my patient walk out of the hospital, on the seventh week after operation, with a limb useful as a means of progression. The splint was not once removed during the treatment, and the anchylosis which resulted was firm and osseous.*

* I am glad to take this opportunity of confirming the statement of the author regarding the opinion entertained as to the inexpediency of this operation, for the result so little anticipated shows the correctness of his views regarding the case in point. I well remember seeing this patient before the operation was performed, and equally with his colleagues I was astonished at his proposal to perform excision, deeming it a very unfavourable case. How-

The following represents a tabular result of my cases:—

No. of Cases.	Cured.	Died.	Amputated.	Recovered.
7	4	2	1	1

ever Price had evidently thought very carefully over this case, and considered that the man was dying as much from disease of the knee as from his pulmonary affection. The immediate relief to the symptoms and the rapid convalescence after the operation justified the author's line of practice. I have already in a previous note referred to this subject, so difficult and so interesting to the surgeon who is anxious to do his duty to his patient and yet not to jeopardize the character of surgery. Strongly, however, as I advocate excision of the knee-joint, I think it hardly desirable to adopt it in cases where there are evidences of tuberculosis in the lungs. It would be more prudent to resort to amputation in such a case.—H. S.



This woodcut illustrates a point to which the author refers in the text, viz., the bowing outward of the limb, which occasionally takes place after the operation of excision of the knee. The drawing is taken from a case where Mr. Fergusson had operated when in King's College Hospital.

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